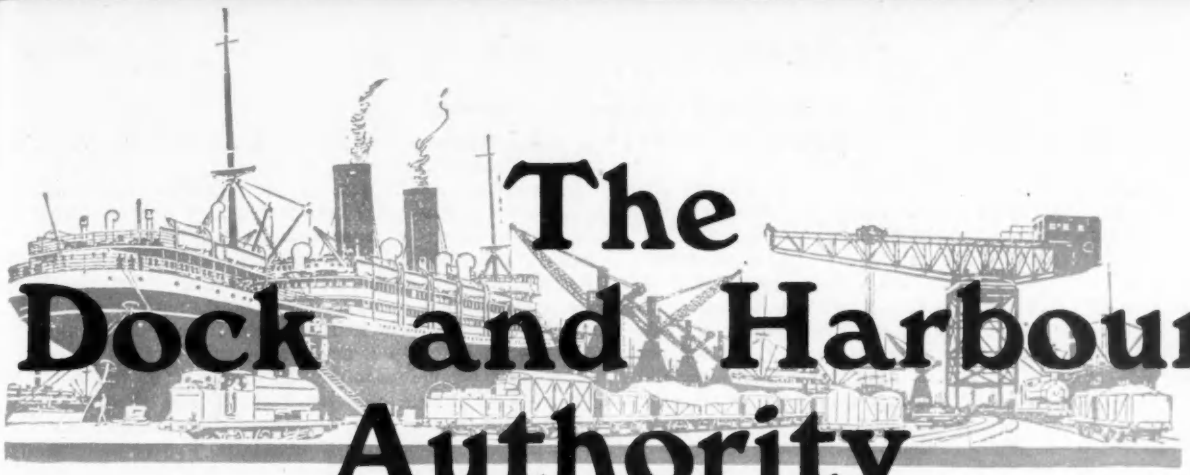

The Dock and Harbour Authority

No. 312. Vol. XXVII. OCTOBER, 1946

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Editorial Comments

Tees-side Developments.

An important stage in the history of the Ports of Middlesbrough and Stockton was reached on the first of August last, when, by the Royal Assent to the Tees Conservancy Bill, the Commissioners were constituted the official Port Authority for the lower river and its environs. With the conferment of the appropriate powers, the Commissioners become responsible for the efficient administration and development of an extensive riparian area in the Tees Estuary. Already, having acquired borrowing powers to the extent of six million pounds, they have formulated plans for an important extension of the dock accommodation and the provision of coal and oil handling facilities, which, as at present existing, are considered by the inhabitants of the district to be inadequate for their commercial needs, present and prospective. Particulars of the projected works are set out in this issue and good wishes will attend the inauguration of a far-sighted constructional programme.

The works in their entirety are obviously likely to take some time to carry out. The mere preliminaries, such as detailed plans and estimates, etc., will, it is anticipated, occupy a period of about twelve months. Until these are completed, it is in fact, impossible for the Commssioners to arrive at the full extent of their requirements and involvements, and various modifications may be found to be necessary in the design as further information regarding its development is elicited by investigation and experience. Moreover, negotiations for the acquirement of the land required for the purpose have still to be undertaken, although some purchase proceedings have already been commenced. Thus, it can be realised that, however energetically pursued, the programme is necessarily a long term one.

And this gives rise to a reflection, which however fanciful it may appear at first sight, should not be lightly ignored, or treated with indifference. It cannot but be felt that in the long awaited Government scheme for the reorganisation of the whole port administration in Great Britain, there are bound to be inherent possibilities of over-riding control which may conceivably interfere with the prosecution of the Conservancy's design on the lines contemplated. Although, no doubt, regrettable from several points of view, this is a contingency to be envisaged in the event of the Government adopting a policy of Nationalisation, under which the activities of British ports in general would be amplified, or restricted, or, at any rate "directed" along certain lines, not necessarily in accordance with the wishes and aspirations of the localities concerned. Such an eventuality must be considered implicit in recent pronouncements of members of the Government.

However, since no Government action has yet been taken and the need for extended dock accommodation is urgent, matters cannot be allowed to remain in suspense, but must proceed without delay. Certainly, Parliament has had an opportunity of considering, and has approved, the steps about to be taken by the Commissioners, and this may bind, or, at any rate, largely influence the policy of any new body created for the general oversight of port affairs in this country. Yet the uncertainty of the present position continues to make it difficult for dock and harbour authorities to embark with confidence on development schemes of any magnitude, and we would urge that the Government should make a definite statement of their intentions without further delay.

The West Riding of Yorkshire, in common with other localities, has suffered severely from industrial stagnation, and the expansion of its industries, using the ports on the Tees as a natural outlet for exports, is a vital necessity, both locally and nationally. The recent announcement by Imperial Chemical Industries, Messrs. Dorman, Long and Co., Ltd., and other large industrial concerns in the neighbourhood of impending developments of their undertakings is a very welcome encouragement for the new Port Authority in their enterprising policy, for which credit is largely due to the energetic action of their chairman, Mr. G. West Byng, ably assisted in technical matters by the members of the staff, which we learn is about to be reinforced by some important appointments in order to cope with the additional demands upon the Commissioners' administrative capacity. Particulars of these changes will be found elsewhere.

Port Administration.

On several occasions in the past the subject of post-war Port Administration has been commented on in the columns of this Journal and readers will perhaps recall, in particular, two articles from the pen of Dr. J. H. Hannay-Thompson, which appeared in June 1944 and in April last. In these were described and discussed the systems at present obtaining in this country, and in the second, attention was directed to certain aspects of Nationalisation as affecting their re-organisation. In the present issue we reproduce an extract from a Paper by the same author, which he contributed to the recent International Technical Congress held in Paris, giving details of a scheme of port organisation which after much study of the mattter, he has devised as an alternative to "Nationalisation as commonly understood." In outline, there would be a "centralised controlling body" for the whole country, with local commissions for the executive administration of individual ports. This, as we see it, is tantamount to transferring all questions of policy and directive to a Government Department in Whitehall, leaving the local body to deal only with ordinary routine matters, an arrangement which, in our view, does not materially differ from nationalisation. Theoretically, it would certainly seem to

Editorial Comments – *continued*

secure uniformity and co-ordination in so far as these are obtainable in a welter of conflicting aims and interests, for it is only too obvious that port affairs, as a whole, present in this country a bewildering problem of unsurpassed complexity. The interrelationship of ports, their respective spheres of influence, the possibilities of their development for distinct branches of commerce and the economical expansion or limitation of their activities, all involve considerations of the most serious, and even vital, importance, calling for the exercise of sound judgment founded on wide experience. But, having said this, it would be short-sighted not to point out that on the other hand, such centralisation would inevitably tend to discourage, and possibly to cripple, the natural enterprise which is at present exercised by local trusts, by reason of the delay, and dilatoriness in dealing with matters, which seem to be the inevitable accompaniment of bureaucratic control.

To furnish an appropriate illustration we have only to remind our readers of the fate of the proposals in regard to post-war re-organisation put forward by the Executive Committee of the Dock and Harbour Authorities' Association and approved by the latter in February 1945. The proposals were submitted to the Minister of Transport in response to a request of his, dated 10th November 1943. Nineteen months have elapsed without a sign of any decision on the part of the Minister and the matter stands like Mahomet's coffin, suspended between earth and heaven.

The Association's proposals differ from those put forward by Dr. Hannay-Thompson in that the former, without disturbing the existing regime, make provision for an Advisory Council to assist the Ministry of Transport in regard to port affairs. Moreover, the Council is limited to 13 members, while the Central Trust of Dr. Hannay-Thompson is designed to consist of at least 25—a number which he considers necessary to represent the extremely varied range of interests involved. Again, as already indicated, its function is not merely advisory. It is intended to take over all governmental power and its decisions are to be final.

We have previously expressed our view that diversity of administration in port affairs is no essential disadvantage, nor is the present order of things so effete and outmoded as to call for fundamental change. Without endorsing it in all respects, we prefer the less revolutionary plan of the Dock and Harbour Authorities' Association to any which involves the establishment of centralised bureaucratic rule. None the less, we commend the carefully planned scheme of Dr. Hannay-Thompson to the thoughtful consideration of our readers.

Free Port Projects.

It was recently announced in the American Press that a formal grant to operate a foreign trade zone at the Port of New Orleans, has been made in accordance with the Celler Foreign-Trade Zones Act of 1934. Application to establish the zone was filed in August 1942, but further action was held in abeyance during the war, as all the port facilities were required for military purposes. The new zone is located on the River Mississippi within the city limits, and will occupy a part of the Public Cotton Warehouse.

The Colmer Committee on Post-War Economic Policy and Planning, in addition to recommending the creation of a free zone on the Gulf of Mexico also advocated the establishment of a zone on the Pacific Coast, and with this end in view, applications have been filed by the Ports of Los Angeles and San Francisco and these have still to be considered.

The United States is not the only country to become interested of late years in the question of Free Ports. In Canada, a Committee headed by the Vice-Chairman of the National Harbour Board, is at present studying applications from several Canadian ports and will prepare a report for the next session of the Canadian Parliament. It is understood that such applications for free port areas have already been made by the Ports of Quebec, Halifax and Saint John, and other ports, such at Montreal, Vancouver and Victoria are also showing a keen interest in the movement.

Lately, suggestions even have been made that a free port should be established in the United Kingdom, and the Chancellor of the Exchequer has announced that he is studying the problem in consultation with the Board of Trade and the Ministry of Transport. The project does not meet with universal approval, however, and adverse criticism has been advanced from different quarters, notably from various Chambers of Commerce who contend that the many difficulties of creating a free port area would outweigh any advantages which may be gained.

In particular, a report of the Transport Committee of the Liverpool Chamber of Commerce states *inter alia* that physical and police barriers round such a port must be complete and effective and it must have within its enclosure or readily available all the facilities of manufacture, as well as of handling. Speed of creation was also essential. Post-war international trade would find its own channels and facilities from which only a heavily subsidised new free port could hope to divert it. Adequate facilities existed for transhipment or re-export in the ports of Great Britain under their present status. The report added that a considerable part of the cost of creating and operating a free port so as to make it sufficiently attractive was certain to fall on the public, which would not reap any benefit for some time to come and would in any event be financing a gamble. Direct shipping services were essential to the success of any free port. Any diminution of such a service—very probably in the use of a British port for continental entrepot trade—was bound to result in increased freightage charges, with consequent higher general cost and greater risk in the entire project.

This Journal on several occasions, has referred to the problems accompanying the establishment of free port areas, and arguments both for and against the system have been freely expressed. As the subject continues to be extremely controversial however, we merely draw the attention of our readers to an article appearing elsewhere in this issue which compares the free port system with present British methods which have hitherto sufficed to meet the needs of the re-export trade.

Shipping Delays and Port Efficiency.

During the past few weeks, prominence has been given to the prevailing unsatisfactory and dilatory methods of cargo handling at ports. Criticism has not been confined to this country only, foreign ports have also been mentioned, and judging by a number of reports received, the position continues to deteriorate and this, in spite of the gradual easing of war-time restrictions and the return to more normal working conditions.

To quote only two examples: speaking recently at the launching of the Blue Funnel Liner *Calchas*, Mr. Lawrence D. Holt, of Messrs. Alfred Holt & Co., Ltd., Liverpool, referred to the difficulties of shipowners. Citing the case of one of the Company's own ships, the *Nestor*, he drew attention to the fact that, before the war, this ship averaged 116 days for each voyage from Liverpool to Australia and back, but since the end of the war, the average time taken had increased to 204 days. The pre-war average time in port abroad was 21 days—it is now 99 days, and during the war was never less than 41 days.

The second example is to be found in reports from South America, which express concern at the slowness of the recovery of the shipping industry since the conclusion of the war. Allusion is also made to the general inefficiency of South American ports, with particular reference to the Republics of Brazil and Argentina. As far as Brazil is concerned, it is reported that the capacity of the ports is insufficient to cope with prevailing demands, and although the Brazilian Government is taking steps to effect an improvement by purchasing additional equipment, some time must elapse before this can be obtained from abroad.

In the case of the Argentine, as is to be expected, chief attention is directed to Buenos Aires, and suggestions have been made that, in order to increase efficiency—especially in regard to cargo handling—the port should be placed under the exclusive management of officials with autonomous powers, assisted by an advisory committee which would include representatives of all the trades making use of the port.

Numerous instances of port inefficiency in other parts of the world could also be quoted, and the cumulative result of these delays and hindrances present a serious handicap to the economic working of sea transport. Time spent unnecessarily in port means a great waste of a ship's carrying power and the problem of improving present conditions should not be left only to the shipowners. Dock and Harbour officials everywhere should carefully overhaul their present methods in an endeavour to produce a higher standard of port working, as only by a quicker turn-round of shipping can the world-wide shortage of consumer goods be alleviated.

The River Tees Development Scheme

Review of Legislative Progress

By HORACE JAMES, F.S.A.A.
(Secretary to the Commissioners).

THE approval of the Tees Commissioners' Bill by the Select Committtee of the House of Lords, where opposition from the London & North Eastern Railway Company was continued from the Lower House, represents the culmination of three years engrossing and close study by the Commissioners of the problems of the River Tees.

Inception of the Scheme

When the Development Committee, under the Chairmanship of Mr. G. West Byng, in October, 1943, set about their task of examining the needs of the River Tees which, from a shipping point of view, had not received over the previous thirty years the attention which they deserved, the Committee in its earlier stages little realised the extent to which their investigations would lead them. The Committee firstly examined the question of dues and charges in the river, which led them to the conclusion that the charges in the River Tees, taking all factors into account, did not compare unfavourably with those existing in other rivers; in fact in certain instances they showed up as being distinctly in favour of this river. They then proceeded to examine the position in regard to the existing facilities and came to the conclusion that, owing to the absence of arrangements under which one authority assumed responsibility for the general progress of the river, its port had, in point of fact, failed to maintain its position in relation to other ports in the country which appeared to have been more enterprising and progressive—this, despite many advantages possessed by the River Tees, such as its easy navigability, its broad and deep channel, and its level banks which invited developments such as one would expect to see in a go-ahead community which generally could be described as a characteristic of the people on Tees-side.

Mr. GEORGE WEST BYNG
Chairman, Tees Conservancy Commissioners

Negotiations with the Railway Company

The Committee gave its Chairman wide powers to conduct conversations and negotiations with all parties concerned in the well-being of the river, arising out of which, as a first move towards opening up the question of the assumption of control by one body, which he rightly felt should be the Commissioners, he opened up discussions with the Chairman and General Manager of the L.N.E.R. Company inviting them to consider the following three alternatives:—

(1) Would the Railway Company very carefully consider the original proposition to construct a new dock on the Wilton site down the river?

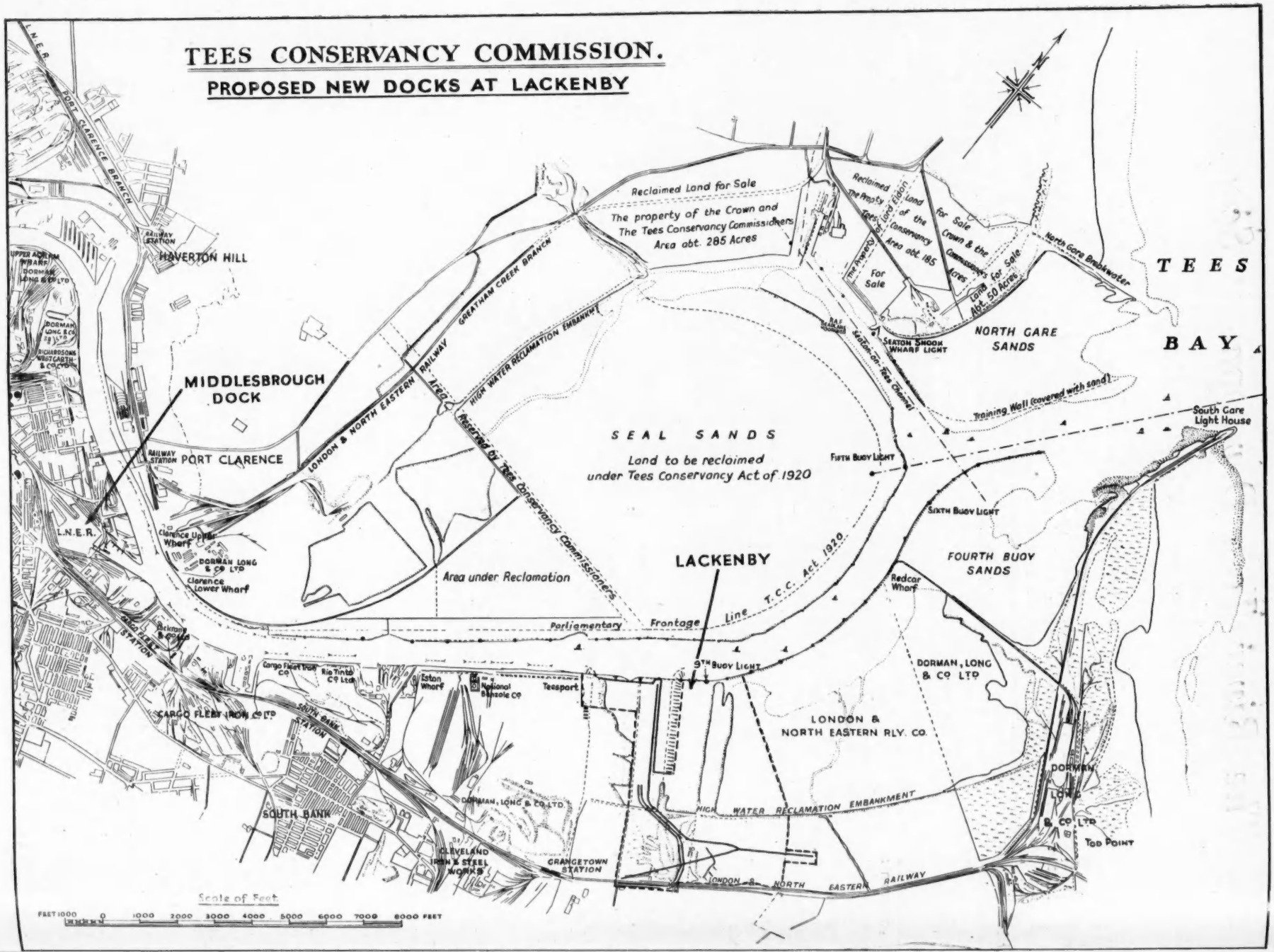
(2) Would the Railway Company consider disposing of the dock to the Tees Conservancy Commission at a reasonable figure?

(3) Failing (1) or (2), would the Railway Company outline what improvements they could embark upon in order to make the dock more attractive to shipping?

In regard to the first-named, it was remembered that the Railway Company had purchased in 1913 one thousand acres of land known as the Wilton Estate on the South Bank within close proximity of the entrance of the river, with the intention of providing additional facilities, owing to the increasing size of vessels which tended to make the Company's existing dock at Middlesbrough inadequate to meet existing requirements. The 1914-18 war intervened, but within a few years after its termination, that is over the years 1923-25, discussions took place between the Railway Company and the Commissioners. The former, after investigation, communicated to the Commissioners their decision not to proceed, on account of expense and paucity of revenue, with the construction of a new dock, but suggested that the Commissioners themselves might, in view of their peculiar position, care to embark upon the undertaking, in which event the Railway Company proffered their advice on engineering and other matters—and the matter had rested there until Mr. West Byng opened discussions with them in 1943. These discussions did not make much progress for a time, notwithstanding the fact that the Chairman of the Development Committee led a deputation of Commissioners for the purpose of pressing upon the Chief General Manager of the Railway Company the need for a careful examination of the three above-mentioned alternatives.

Advice of Consulting Engineers.

Whilst awaiting an answer from the Railway Company on the subject principally of the future ownership of the Middlesbrough Dock which the Commissioners were anxious to purchase at a reasonable price and control as a first step in the assumption of unification of authority in the river, the Commissioners were fortunate in securing the personal services of Mr. E. J. Buckton, the senior partner of Messrs. Rendel, Palmer & Tritton, Consulting Engineers, who was asked to make an investigation of the existing facilities of the river and formulate plans for its future development. This he proceeded to do and his subsequent report confirmed the views of the Development Committee in regard to the desirability of acquiring control of the L.N.E.R. Dock and effecting improvements therein, and with this he coupled the development of an adjoining area fronting on to the river known as "Parsons Site" and representing the former shipbuilding yards of Sir Raylton Dixon & Co., Ltd. and Wm. Harkess & Son, Ltd., which had gone out of use some twenty years earlier. The adoption of this latter site for the purpose of providing deep-water quays in the river, adjoining and abutting on to the existing L.N.E.R. Dock, in the view of the Consulting Engineers would provide an easing of the cramped conditions existing in the dock owing to the increase which had taken place in the size of the ships since the date of the dock's original construction. As a long-term policy the Consulting Engineers recommended the purchase of an area of land stretching from Teesport to a distance beyond the Ninth Buoy Light, which


TEES CONSERVANCY COMMISSION.
PROPOSED NEW DOCKS AT LACKENBY
L.N.E.R.
PORT CLARENCE BRANCH
RAILWAY STATION
HAVERTON HILL
UPPER ACKLAM WHARF
DORMAN LONG & CO LTD
DORMAN LONG & CO
RICHARDSONS WESTGARTH & CO LTD
MIDDLESBROUGH DOCK
RAILWAY STATION PORT CLARENCE
LONDON & NORTH EASTERN RAILWAY
GREATHAM CREEK BRANCH
HIGH WATER RECLAMATION EMBANKMENT
Reclaimed Land for Sale
The property of the Crown and The Tees Conservancy Commissioners
Area abt. 285 Acres
Reclaimed Land for Sale The Property of the Tees Conservancy Commissioners Area abt. 185 Acres
The Property of Lord Eldon for Sale
Land for Sale Crown & the Commissioners Acres
Land for Sale Abt. 50 Acres
North Gare Breakwater
TEES BAY
NORTH GARE SANDS
SEATON SHOOK WHARF LIGHT
Seaton on Tees Channel
Training Wall (covered with sand)
South Gare Light House
SEAL SANDS
Land to be reclaimed under Tees Conservancy Act of 1920
Reserved by Tees Conservancy Commissioners
Area under Reclamation
LACKENBY
T.C.C. Act 1920.
Parliamentary Frontage Line
FIFTH BUOY LIGHT
SIXTH BUOY LIGHT
FOURTH BUOY SANDS
Redcar Wharf
9TH BUOY LIGHT
DORMAN, LONG & CO LTD
LONDON & NORTH EASTERN RLY. CO.
Clarence Upper Wharf
DORMAN LONG & Co LTD
Clarence Lower Wharf
Cargo Fleet Iron Co
Rio Tinto Co Ltd
Eston Wharf
National Benzole Co
Teesport
CARGO FLEET IRON Co LTD
SOUTH BANK STATION
SOUTH BANK
DORMAN, LONG & CO LTD
HIGH WATER RECLAMATION EMBANKMENT
CLEVELAND IRON & STEEL WORKS
GRANGETOWN STATION
LONDON & NORTH EASTERN RAILWAY
TOD POINT
Scale of Feet
FEET 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 FEET

River Tees Development Scheme—continued

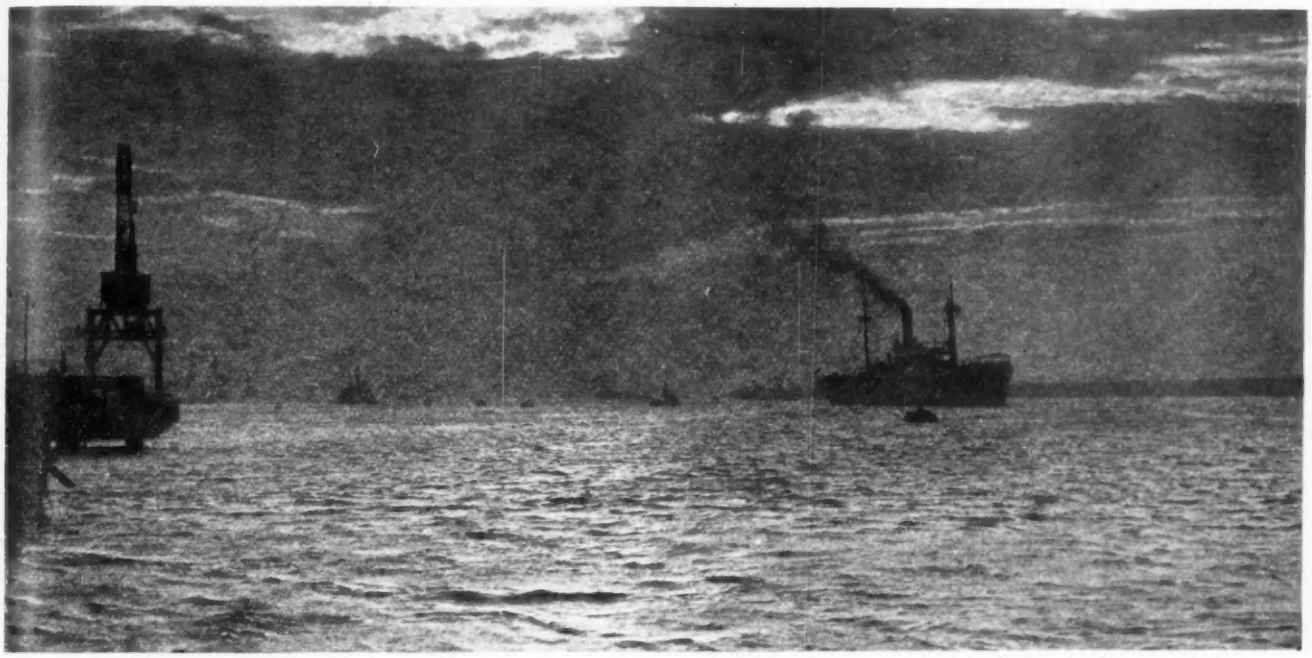
included the Wilton Estate of the L.N.E.R. Company, referred to earlier, and a large proportion of which represented unreclaimed foreshore and that upon this land and foreshore should be constructed a system of open docks which would permit of development over very many years. Mr. Buckton, however, counselled that the initial stage of development comprising a dock cut 2,500-ft. long, with quays the full length of one side to provide accommodation for five 500-ft. ships, might well be proceeded with as a short-term policy to link up with the purchase and development of the dock and the development of the Parsons Site.

Co., Ltd., and embodied with the existing dock in a scheme for improvement and development.

(e) That steps should be taken to acquire sufficient land at Lackenby for the purpose of constructing a system of open docks.

(f) That steps should be taken to obtain the necessary additional Parliamentary Powers.

Reference was also made to the report of the Government's White Paper on " Employment Policy " and the Distribution of Industry Act, 1945, Section 3.



Photograph taken from the low end of Smith's Dock Co's. premises on the south bank of the River, looking upstream. In the foreground on the left is a crane at the Fitting Out Basin of Smith's Dock Co's. Shipyard and in the background on the left is the Cargo Fleet Ore Discharging Plant, with a ship alongside.

Development Committee's Report

Mr. Buckton's recommendations were embodied in the Development Committee's Report which included a number of recommendations, the principal of which were the following:—

(a) Reclamation.—A slowing down of the Conservancy's reclamation work.

(b) Dredging.—That as soon as practicable after the cessation of hostilities the Commissioners should implement their 1937 policy of dredging, i.e., an additional 5-ft. from Fifth Buoy to Tees (Newport) Bridge, making 30-ft. below L.W.O.S.T. at the former and 20-ft. at the latter. This dredging it was recommended should be placed with a firm of dredging contractors who had tentatively given a figure of £434,000.
As regards the dredging from the Newport Bridge to Victoria Bridge, Stockton, this would be undertaken by the Commissioners' own Engineer.

(c) That there should be co-ordinated development of the ports of the River Tees; that there should be one authority in the estuary; and that to this end the control and supervision of the London & North Eastern Railway Dock at Middlesbrough should be transferred to the Commissioners either by way of purchase from the Railway Company at a reasonable figure or as the result of Government direction.

(d) That a site at Dock Point adjacent to the L.N.E.R. Dock should be acquired from Parsons Marine Steam Turbine

Industrial Developments

After receiving the approval of the Board of Commissioners on 18th April, 1945, the report was then submitted to the Ministry of War Transport. It was only a few weeks after the publication of the report that the Imperial Chemical Industries Limited and Messrs. Dorman, Long & Co., Ltd. each announced their important developments in the immediate vicinity of the site proposed for the new docks, in consequence of which, what was originally a long-term policy became a policy for the near or immediate future. A few months later the Minister of War Transport intimated that he saw no reason why the Commissioners should not proceed with the drawing up of a Bill to secure the objects they had in mind. In this connection it was appreciated that in accordance with Parliamentary procedure, private bills have to be lodged in Parliament before the end of November, and although it meant working at high pressure, the Commissioners duly lodged their new Bill on the 27th November, 1945, in the realisation that time was a matter of importance in view of the important developments taking shape in the locality.

In the meantime, that is in May 1945, negotiations were reopened with the Railway Company, but these dragged on so long that no decision had been arrived at within the short period of the time for the lodging of a petition. In these circumstances the Railway Company apparently felt it their duty to oppose the Bill and in particular the proposed purchase of the Middlesbrough Dock and the compulsory acquirement of their site at Wilton. The Railway Company taking this action was a great disappointment to the Commissioners, in view of the friendly atmosphere which

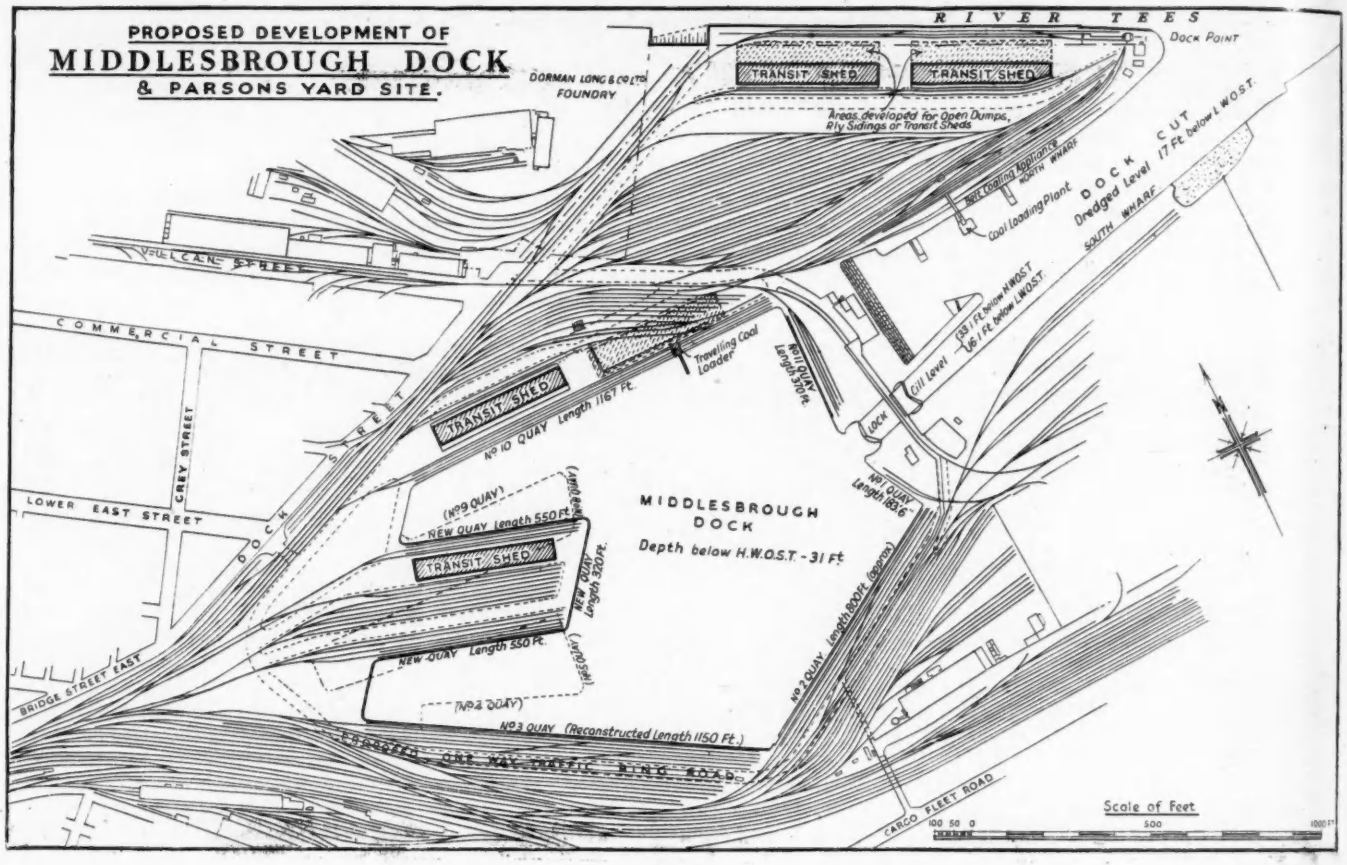

PROPOSED DEVELOPMENT OF
MIDDLESBROUGH DOCK
& PARSONS YARD SITE.
RIVER TEES
Dock Point
DORMAN LONG & CO LTD FOUNDRY
TRANSIT SHED
TRANSIT SHED
Areas developed for Open Dumps, Rly Sidings or Transit Sheds
Coal Loading Platforms
Coal Loading Plant
NORTH WHARF
DOCK CUT
Dredged Level 17 Ft. below L.W.O.S.T.
SOUTH WHARF
VULCAN STREET
COMMERCIAL STREET
Travelling Coal Loader
No 11 QUAY Length 550 Ft.
38 1/2 Ft. below H.W.O.S.T.
36 1/2 Ft. below L.W.O.S.T.
Sill Level
LOCK
TRANSIT SHED
No 10 QUAY Length 1167 Ft.
GREY STREET
DOCK STREET
LOWER EAST STREET
(No 9 QUAY)
NEW QUAY Length 550 Ft.
TRANSIT SHED
MIDDLESBROUGH DOCK
Depth below H.W.O.S.T. - 31 Ft.
No 1 QUAY Length 836 Ft.
NEW QUAY Length 320 Ft.
(No 8 QUAY)
NEW QUAY Length 550 Ft.
No 2 QUAY Length 800 Ft. (approx)
BRIDGE STREET EAST
(No 2 QUAY)
No 3 QUAY (Reconstructed Length 1150 Ft.)
PROPOSED ONE WAY TRAFFIC RING ROAD
CARGO FLEET ROAD
Scale of Feet
100 50 0 500 1000 Ft.

Fig. 2.

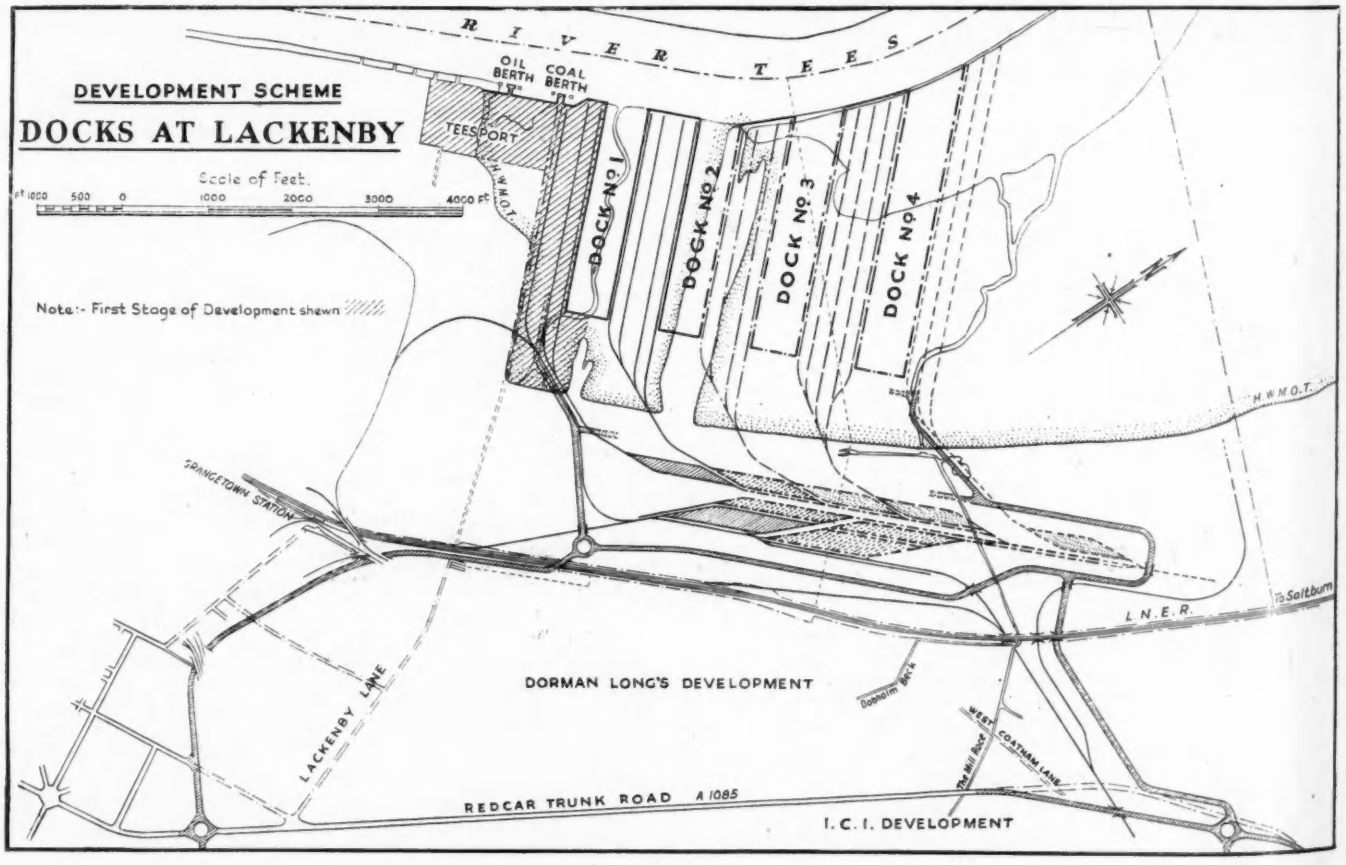

RIVER TEES
DEVELOPMENT SCHEME
DOCKS AT LACKENBY
Scale of Feet.
1000 500 0 1000 2000 3000 4000 Ft.
OIL BERTH
COAL BERTH
TEESPORT
H.W.M.O.T.
DOCK No 1
DOCK No 2
DOCK No 3
DOCK No 4
Note:- First Stage of Development shewn
H.W.M.O.T.
SPRINGFIELD STATION
To Saltburn
L.N.E.R.
DORMAN LONG'S DEVELOPMENT
LACKENBY LANE
Dabholm Beck
WEST COATHAM LANE
The Mill Road
REDCAR TRUNK ROAD A 1085
I.C.I. DEVELOPMENT

Fig. 3.

River Tees Development Scheme—continued

had been maintained throughout the negotiations. The Commissioners strongly felt it their duty, however, to press on with the Bill in view of the importance of their proposals from the national as well as the local point of view. They withdrew, however, from the Bill the proposed purchase by agreement of the existing dock and the proposals relative to the development of Parsons Site.

Railway Company's Attitude

In their petition, and in the presentation of their opposition in both Houses, the Railway Company alleged that their existing dock was quite capable of handling all foreseeable traffic and that the proposed new docks were unnecessary. The Commissioners' case was supported by their Chairman (Mr. West Byng had been appointed Chairman of the Board in the preceding November), Ald. L. G. Allen, the Mayor of Middlesbrough, who also represented other local authorities in the neighbourhood, and shipping interests and traders using the river. Supporting evidence was also forthcoming from the Consulting Engineers and a Financial Adviser. For the Railway Company, Mr. Jenkin Jones, Divisional General Manager, North Eastern Area, was the sole witness before the Select Committee of the House of Commons and he also gave evidence in the House of Lords, but on this occasion he was supported by Sir Ralph Wedgwood, the former Chief General Manager of the Company. The Commissioners, in the Second House, had the same witnesses, with the addition of supporting evidence from Captain T. J. M. Mackenzie—Chief Marine Superintendent of Messrs. T. & J. Brocklebank (of Liverpool), and Captain Bruce Glasier—Chief Marine Superintendent of the Glen Line (of London). The Bill was approved by the Select Committees of both Houses, and the Royal Assent was forthcoming on the 1st August 1946.

During the last twelve months the Imperial Chemical Industries Limited, Dorman, Long & Co., Limited, and the Tees Commissioners have been working together in a friendly and constructive atmosphere, with the result that all their schemes dovetail excellently into one another to the mutual advantage of all three parties. It will be appreciated that the direct access which will be available between the new docks and these two large firms will represent a definite saving in time and money; moreover, it is hoped that the initial stage of the construction of the new docks will prove an attraction to shipowners and shippers by reason of modern and efficient facilities, together with road access, which will fulfil a long-felt want, permitting as it will road transport to discharge and load into and from transit sheds or vessels themselves. There is no doubt that the prospect of the introduction of this new industry on Tees-side and its consequent employment will be greatly welcomed and prove a boon to all concerned in the development of the district, which, it will be remembered, falls within the scope of a development area.

Pontoon Dock built by the Furness Shipbuilding Co., Ltd., Haverton Hill-on-Tees, being towed to sea on the first stage of its journey to the Port of Durban, South Africa, for the South African Railways and Harbours Commission.

Committee and Terms of Reference

The following is a list of the Development Committee of the Tees Conservancy Commissioners as appointed in 1943.

Mr. G. West Byng (Chairman), Mr. W. W. Constantine, Sir William Crosthwaite, Mr. B. O. Davis, Sir G. Tristram Edwards, Dr. A. Fleck, Mr. T. Meehan, Mr. W. Newton, and Mr. J. Wesley Brown, who, dying in November 1944, was succeeeded by Mr. R. S. C. Wilkinson.

The Committee's terms of Reference were as follows: "That the duties of this Committee be to examine in detail the report of the Tees Engineer to the Post-War Development Committee; to consider the proposals outlined therein together with any other proposals put forward by members of the Committee which, in the light of their experience as representatives of industry, shipping and commerce, would, in their opinion, be beneficial to the post-war prosperity of the Tees Ports; to formulate, together with the present scheme of river improvement and reclamation, a considered policy of progressive development for submission to the Board of Commissioners."

Consulting Engineer's Report

The Report of the Consulting Engineers, Messrs. Rendel, Palmer & Tritton, which, as already stated, was prepared before the Bill was presented to Parliament, is too lengthy for complete reproduction. Their conclusions, as drawn up at that time, are briefly summarised below.

(i) The Tees River is an exceptionally good one and favourable for expansion of port facilities.

(ii) The port now caters almost exclusively for the requirements of the various heavy industries established along the banks of the river, but is lacking in facilities for handling general cargo trade

River Tees Development Scheme—continued

and thus serving the import and export requirements of a more extensive area.

(iii) In the interests of trade and shipping as well as for the co-ordinated development of the port, there should be one Dock Authority on the river, and to this end Middlesbrough Dock should be acquired from the Railway Company by the Tees Conservancy Commissioners.

(iv) Close and friendly co-operation with the Railway Company is essential to the efficient development and working of the port. The railway system has been extensively developed throughout Middlesbrough and district, and rail transport is likely to carry the bulk of the trade both at the present dock and at the proposed new extensions.

(v) Future extensions of the port should be on the South side of the river, and should be nearer the sea than the existing docks and wharves in view of the greater depths required for modern shipping.

There are certain undeveloped areas on the South side, East of Grangetown Station between the railway and the river, referred to in this report as the Lackenby site, which are very suitable for the development of open or closed docks, and could, no doubt, be acquired for this purpose.

(vi) In Middlesbrough itself, the present centre of port activity, conditions are too congested to permit of any considerable development, but a general improvement and modernisation of the existing facilities in the dock and in the river are urgently needed.

Provided the L.N.E.R. Dock is acquired by the Commissioners, then Parsons site at Dock Point can be developed in conjunction with the North side of the dock so as to give improved facilities in the dock at No. 10 quay and provide a two berth riverside quay for general cargo (as shown on Fig. 2).

Further improvement within the dock is possible by substituting one pier for the two existing piers and deepening the berths on the South side, but this is relatively expensive work for what is gained, and it should not be undertaken in preference to commencing a new dock cut lower down the river.

(vii) The provision of additional quayage, after the improvements at No. 10 quay and Parsons site have been completed, should take place on the Lackenby site, and should consist of an open dock or cut, with a line of quays on the west side only of the first docks as a first instalment (as shown on Fig. 3), the second instalment being the provision of quayage on the east side.

Further extensions (as indicated on the same Drawing) would be undertaken in the future as and when prospective trade and other circumstances justify. These later developments planned for the future may be additional open docks, or closed docks if ships of considerable greater draft have to be catered for.

To avoid railway bottlenecks in Middlesbrough, the proposed dock extensions on the Lackenby site should be provided with their own separate system of railway sidings independent of the existing sidings west of the town at Newport.

(viii) Sufficient land should be acquired at the down-river site to provide for a reasonable extent of future development, in addition to what is needed for the first instalment, and the scheme should include areas to be leased for industrial and commercial purposes.

(ix) In all improvements or new extensions, facilities for road as well as railway transport should be provided.

(x) The supply of bunker coal to ships is likely to be a diminishing demand, in view of the rapidly increasing use of fuel oil. While, therefore, adequate bunkering facilities must be provided, it is important to see that these are not excessive to present requirements. For the improvements at the dock it would appear sufficient to instal one modern bunkering appliance at No. 10 quay in the dock, to retain the existing appliance in the dock cut, and to make some inexpensive provision for supplying bunker coals to vessels using the new riverside quay at Parsons site. Later it may be possible to dispense with coal bunkering facilities within the dock and to centralise coal bunkering at the new site in the river adjacent to the entrance to the new open dock down river, in which case the modern appliance recommended for installation at No. 10 quay might be transferred to the new site.

(xi) There is a need for better oil bunkering facilities on the river, and a site is provided for an oil fuelling station in connection with the down-river extensions. Pending this development it is understood that temporary facilities can be provided by co-operation of the oil marketing companies.

(xii) The reclamation on the north side of the river, carried out by the Commissioners under the 1920 Act, is not suitable for port development, being on the wrong side of the river, and it is not particularly attractive as an industrial site so long as its river frontage is set back from the navigable channel and the land approaches are undeveloped.

If a favourable opportunity occurs for getting slag deposited cheaply at this site so as to advance the frontage, it should be taken, but it is recommended that the whole policy of reclaiming the Seal Sands should be held in abeyance, at any rate until there is a clear demand for more sites on that side of the river.

(xiii) If the reclamation of the Seal Sands is not proceeded with, the river channel need be made no wider than navigation needs dictate, and this will afford a considerable saving in dredging compared with what is needed for the widths proposed in conjunction with the reclamation scheme.

(xiv) As regards channel depths it is considered that the 1937 dredging programme which provides for 30 feet at 5th Buoy Light and 25 feet at Dock Point is likely to meet requirements for many years.

(xv) Additional parliamentary powers will be needed for the implementation of the development programme outlined in this Report and to enable the Commissioners to exercise all the functions of a dock authority on the river.

Staff Appointments

Recognising the increased responsibilities and greater opportunities open to them in their now wider sphere of activities, the Commissioners have made the following appointments.

Mr. J. S. B. Gentry, C.I.E., O.B.E., Commercial Superintendent of the Port of London Authority, has been appointed General Manager of the Tees Conservancy Commission.

Having served with the Port of London Authority for nearly 30 years, Mr. Gentry has had considerable experience in port administration, operation and management. During the recent War he discharged many responsibilities connected with shipping and docks in different parts of the World. In 1939-40 he was Assistant Director of Docks in France. After the evacuation from France he was loaned to the Ministry of Transport to assist in the development of the Clyde Anchorages Emergency Port. From 1941 until early 1944 he was Deputy Director of Movements (Shipping and Docks) in the Middle East where he was responsible for the organisation, development and operating of all Mediterranean and Egyptian Ports as well as a number of others in the Red Sea. In April 1944 he was loaned to the Government of India and became Deputy Port Director for Calcutta during the period that this port was so vital as a base for the operations in Burma, supplies to China and the build-up for the campaign further East.

Mr. Gentry will take up his duties in Middlesbrough in the near future.

Mr. Horace James, F.S.A.A., who joined the Commission in 1933, and succeeded Mr. F. T. Nattrass in 1942 as Clerk to the Commissioners, has been given the added status of Secretary in view of the widened powers conferred upon the Commissioners under the Tees Conservancy Act, 1946, which includes powers to trade. It is fitting that he should have been given this recognition, as his experience first with Messrs. Peat, Marwick & Mitchell and then with the Commissioners has qualified him for the increased responsibilities which he will henceforth carry.

Mr. P. A. R. Leith, M.I.C.E., who has served the Tees Conservancy Commissioners as Engineer for the past 20 years, has been appointed Chief Engineer to the Commissioners in view of the extended activities which are now envisaged. Prior to his service with the Tees Conservancy Commission, Mr. Leith was Chief Civil and Mechanical Engineer to Smith's Dock Company.

Free Trade Zones and Re-Export Reliefs

Alternative Methods Compared

By G. R. STOCKS.

It is remarkable that Great Britain alone of the great seafaring nations has never possessed a Free Port. Free Ports were in existence at Leghorn, Hamburg, Bremen, and Lübeck in the fifteenth and sixteenth centuries. Danzig and Copenhagen were free ports before the war, and similar privileges had been enjoyed since the 1920s by Stockholm, Gothenburg, and Malmo. Further examples in Europe are Trieste on the Adriatic, and Sulina at the mouth of the Danube. The system had been adopted in the Far East by the Ports of Hong Kong, Singapore, Penang, and Macao. A Free Zone was created in the Port of New York in 1937 and a second zone was opened at the Port of Mobile in 1938, but this was apparently unsuccessful, as the privileges were withdrawn in 1939. The most recent Free Port to be created is a zone in the Port of New Orleans, which was granted as late as July 1946. It is, therefore, obvious that certain ports with special trades and peculiarly favourable location have benefited from the adoption of free port privileges.

Functions of a Free Port

A Free Port or Free Zone has been defined in recent years as follows: "An isolated, enclosed and policed area, in or adjacent to a port of entry. It has no resident population, is furnished with the necessary facilities for lading and unlading, for supplying fuel and ships' stores, for storing goods and re-shipping them by land and water. It is an area within which goods may be landed, stored, mixed, blended. re-packed, manufactured, and re-shipped without the intervention of Customs officials. It is subject equally with adjacent areas to all the laws relating to the public health, vessel inspection, postal service, labour conditions, immigration and, indeed, everything except Customs." Needless to say, all Free Ports do not fall strictly within this definition, although in broad principles they approach it.

The object of Free Ports and Free Zones is to alleviate the adverse effects of a revenue tariff, particularly on the entrepot and re-export trades. A certain commodity is dutiable in this country. Merchants may desire to import that commodity, not for consumption or use in this country, but for immediate or subsequent export to another. In strict law this commodity is liable to duty, but if the merchant paid that duty, his costs would be increased, and his price to the ultimate consignee abroad would necessarily be increased to cover the cost of the duty. That being so, he is in an unfavourable position to compete in the foreign market where the original consignor and probably other merchants can operate without the additional costs of the British Customs duty. Under a Free Port system, too, he has complete freedom of manipulation of his goods in the area and facilities for manufacturing processes. The main reason for the existence of a Free Port, then, is to obviate paying duty on goods intended to be re-exported. There are other ways of achieving this object.

Present British Methods

In Great Britain there are three main methods of relief to the re-export trade, and these have so far been considered adequate without granting Free Port privileges. Probably the most important is the bonded warehouse system. Originally designed to allow the duty-free storage of high duty goods such as spirits, wines and tobacco, it has been extended with the expansion of the tariff to include almost all goods within the scope of the tariff. Bonded warehouses may be approved for general use, or they may be restricted to one class of goods or to the use of one particular trader. Duty need not be paid until the goods are actually required for home use, or, if to be exported, no duty is payable at all.

Another method of alleviation to the re-export trade is the transhipment system whereby goods imported by one ship may be transferred to an outward bound ship in the same or another port, with minimum Customs interference, and without payment of duty.

The third main relief is provided by the drawback system which requires duty payment in the first place of imported or home-produced goods liable under the tariff. The goods may undergo a process of manufacture or incorporation in another article before being exported. On proof of shipment intact being given, the duty may be repaid, subject to the satisfaction of the authorities. Other facilities are given to allow trade samples to be imported duty-free, at reduced or flat rates of duty, or in quantities otherwise inadmissible; to allow the import and re-export or the re-import after export of Commercial Travellers' Samples with the minimum of Customs formality; and to allow the duty-free importation of patterns and templates. In our present methods of trading, all these reliefs are used extensively and all have stood the test of time, but they are not altogether free from objections.

Bonded warehouses are under strict Revenue supervision, the merchant has limited opportunity to handle and operate on his goods, and his costs are increased owing to the provision of bond, etc. Transhipments involve Customs control, a time limit to transactions, and bond to cover the duties involved until the goods are shipped on the exporting vessel. Claims to drawback necessitate merchants' keeping special accounts, the provision of bond, and official sampling and verification. More latitude is allowed, however, in preparing goods for their market. All the methods of relief outlined entail Customs formality of varying strictness, and an indefinite additional expense which adds to the ultimate cost of the goods.

Free Port System Advantages

In favour of Free Ports it is claimed that they facilitate the removal of imported goods from vessels and quays, and enable ships to arrive and depart more quickly. There are no Customs restrictions as to hours of working, tallying for official purposes, production and holding of goods for examination, and general delay during entry and clearance. The system obviates the complications of bonding and the intricate methods of claiming drawback on exported dutiable goods. Further, it gives the merchant full control at all times over his goods and there are adequate facilities for the display and sampling of goods in the area. Processes to prepare goods for their market may be carried out without Customs restrictions, such as assembling of machinery, manufacture, incorporation of home-produced with foreign goods. Goods may be imported in bulk and repacked or mixed with other goods and prepared for market either for home use or abroad. From the financial standpoint Free Ports release capital now tied up in Customs duties or in Customs requirements. Capital thus released may be used for further enterprise, and this, coupled with the more rapid turn round of ships and movements of cargoes, decreases capital requirements. It is further claimed that Free Ports, particularly those in the U.S.A., cut down terminal costs, which may amount to 60 per cent. of the total cost of ocean transport. The Revenue authorities gain an advantage in that smuggling is reduced to a minimum, since traffic can leave a Free Port only through a few well-defined channels.

Free Port Disadvantages

The objections to Free Ports are mainly the practical difficulties of creating suitable isolated areas, which must yet be accessible to shipping and all other facilities. Moreover it has been held that Free Ports tend to create monopolies, and a better method would be to alter the existing laws and procedure, thus conferring a general benefit, rather than one limited to a few chosen localities. It has also been objected that Free Ports may become dumping grounds to hold goods duty-free until prices are favourable, when they are released, thereby depriving home manufacturers of legitimate profits. Free Ports are beneficial only if the bulk of the goods imported are destined for re-export. Goods destined for home use are subject to the normal Customs control when they pass out of the area. Also difficulties may arise as to the identity of goods, if they have been extensively operated on within the free zone, and special regulations may be necessary when evidence of origin, age, or value is required.

Method of Relief Dependent on Particular Needs

The Free Port system may or may not be preferable to a comprehensive warehousing system combined with drawback facilities. That depends upon the needs of the particular trade in the port and its hinterland. In theory, wherever there is a large entrepot

Free Trade Zones and Re-Export Reliefs—continued

and re-export trade, the free port system is preferable, provided a suitable area can be isolated and formed into a free zone. This should in no way interfere with existing docks and trade, but at the same time the free zone should have all transport facilities by water, rail, and road.

We cannot yet forsee what the post-war development of international trade will be like. Free Ports have not so far been tried out in Britain. Now may be a favourable time, when it is vital to help our re-export trade by all possible means.

Port Administration

Proposal for New Administrative Organisation

At the International Technical Congress, held in Paris on the 17th to the 22nd September, a Paper was read by Dr. J. H. Hannay-Thompson, General Manager and Engineer, Granton Harbour, Edinburgh, on " The Pre-War Systems of Port Administration, with suggestions for a Post-War Scheme."

The first part of the Paper is largely a recapitulatory of information contained in articles on the subject which appeared in issues of this Journal for June 1944, and April last.* It is only necessary, therefore, to publish the additional statement of Dr. Hannay-Thompson's views on the constitution of a proposed new port organisation, which is as follows.

Proposed New Administrative Organisation

There should be a centralised controlling body in each country, in the form of a Central Trust with national scope, which would treat all ports as parts of a whole. The individual ports should be controlled in local matters by Commissions, and all should be run on similar lines.

Central Organisation—Functions: The Central Trust should have power to lay down the basic principles of Port Administration for the country, and to decide all major issues of policy for each port and co-ordinate the efforts of all. Its functions should be judicial rather than administrative. All the financial powers and resources of the ports should be vested in it, and all Port Stock, Debts or Loans should be combined in a Central Capital Fund.

This Central Trust should take over all Government functions, such as those at present carried out by the British Parliament and the French State Departments. Its decisions should be final. It should be administered upon the same principles as those at present governing the Trust Ports, and it should take over the property in the assets of all ports and assume all their liabilities. by way of invested capital or loan debt. It should also control all surplus revenues or deficiencies of individual ports. In the case of countries with a National system of administration, the State would have to receive a capital sum in return for the assets, and it would have to surrender control of the revenue and expenditure, which would be placed in the hands of local Commissions under the control of the Central Trust. In such countries, and newly developed or Colonial countries, it might be necessary for the State to provide part of the capital for the Central Trust, or guarantee the Interest and Sinking Fund.

The Central Trust, through its control over the Central Funds, should exercise a judicial faculty in deciding the rival claims of the different ports for new facilities or trades. It should be able to see that such trades were routed in the most economical manner, and further that proposals for such new facilities as were required showed sufficient breadth of vision to be adequate for the anticipated requirements of the port for a considerable period, but, at the same time, were not in excess of those requirements viewing the trade of the country as a whole.

It should be in a position to prevent the construction of obviously redundant facilities where ports were competing for the same trades, and have powers to require a port to improve its facilities to meet increasing trade, or in the event of their becoming obsolescent, to close ports or portions of them which were out-of-date and working at a loss.

The Central Trust should have the power to lay down the basis upon which the rates levied in the individual ports should be fixed, but should not fix the port's individual rates or concern itself with details of local administration.

The Central Trust should be composed of men who would review all questions in a judicial capacity without favouring or endeavouring to obtain undue favours for any section of industry or the interests they represent. It will be necessary to attract men of high calibre and extremely wide experience, who will carry out their duties from a National viewpoint.

The Central Trust—Constitution: It is proposed that the Central Trust should be composed of about twenty-five members, who would represent the various activities which have an interest in ports. The members should serve for periods of five years, and one-fifth of the members in rotation should retire annually, and be eligible for re-election. One impartial representative of each category should be sufficient. Trade and shipping representation should balance port official representation with a certain number of Government representatives or nominees. The representatives of a Trade or other interest upon the Local Commissions would elect the corresponding representative upon the Central Trust. Government representatives would be appointed by the Department concerned, while legal or other experts would be co-opted by the members already elected or appointed to represent the other port interests. All members of the Central Trust should receive a high remuneration for their part-time services upon the basis of fees for attendance. For each member of the Central Trust a deputy or substitute member would require to be appointed in the same manner as the principal Trustee, whose place he would take when he was absent, and with whom he should be in consultation. The Trust should meet as a full Board upon all occasions. Leave of absence from meetings would require to be asked and received, except for emergency cases due to health. A measure of non-attendance would result in disqualification from representation upon the Trust. The Trust should settle all matters by vote, the Chairman to have an additional or casting vote.

The position of Chairman and Vice-Chairman should be whole-time and highly salaried. The Chairman should be appointed by the Government Transport Department for his ability to exercise an administrative or judicial faculty rather than a managerial faculty. The latter function should be delegated to the Vice-Chairman who would be elected by the members of the Central Trust.

The detailed composition of each Trust would require minor modifications to suit each individual country, but its constitution should be generally along the following lines:—

Administrative Chairman.
Executive Vice-Chairman.

One representative of each of the following:—

Foreign Shipping.
Home Shipping.
Coastal Shipping.
Inland Water Transport.
Railway Transport.
Road Transport.
Lighting and Buoying Service.
Port Labour.
Imported Raw Materials.
Imported Food Stuffs.
Imported Manufactured Goods.
Exported Manufactured Goods.
Exported Coal or Minerals.
The Municipalities.
Harbour Engineering Consulting Expert.
Harbour Financial Expert or Economist.
Legal Expert.
Government through Ministry of Transport.
Government through Admiralty or Naval Service.

About six representatives of ports according to geographical groups.

*Evolution of Port Administration in Great Britain, June, 1944, and Port Administration: Aspects of Nationalisation, April, 1946.

Port Administration—continued

It is probable that the Port representative would be the Chairman-Director of the principal port in his group. The actual number of such groups might have to be varied slightly to suit individual cases, as might the number of shipping and trade representatives in accordance with their relative importance and the revenues which they contribute.

Local Commission—Functions: The controlling body in each port should be in the form of a Commission which would function in a manner generally similar to the Central Trust, but dealing only with affairs concerning its own port or local minor ports under its control.

The Commission would be responsible for the finance of its own port, i.e., for its working and maintenance, and for the contribution of its quota to the revenue of the Central Trust. It would have powers to execute minor capital works, and provide plant out of its own revenues up to a figure to be predetermined for each port. The sanction of the Central Trust would be required for all items in excess of this, or for which a grant would be needed from the Central Funds.

The rates should be fixed by the Local Authority in a manner similar to that at present in force in the Trust-owned harbours. The rates derived from the trades normally handled by the harbour should be sufficient to cover the working expenditure and maintenance of the harbour, and the capital cost of all smaller items of plant below a certain figure, together with the interest and redemption charges of its share of the Central Capital Fund. This share might be made proportionate to the average tonnage of vessels or value of goods passing through the port over a number of years. The fairest distribution of these charges is that at present in many ports. The total charge should be approximately equally divided between vessels and goods, and the individual charges varied in accordance with the expenses of the accommodation required by goods and vessels and the regularity or otherwise of their sailings, and the ability of the goods to pay in accordance with their intrinsic value.

All ports, while retaining a large measure of independence, would function as parts of the same organisation, with consequent interchange of plant and personnel, and the resulting economies where unnecessary duplication has occurred.

As in the Central Trust, the functions of the Commission should be more judicial than executive. It should decide all questions by vote. It is intended that it should only lay down the principles of the detailed policy, and decide issues of major importance, leaving all minor matters of routine for the decision of the chief official and execution by the routine staff.

Local Commission—Constitution: The Commission should be composed of about fifteen members, appointed or elected by those qualified to do so, to represent the various activities which have an interest in the port. The members should serve for periods of five years, and one-fifth of the members in rotation should retire annually and be eligible for re-election. There should be only one representative in each category, assisted by a deputy or substitute member, who would be permitted to attend meetings for his own information, but only to vote when the principal member was absent.

The chief executive officer should be constituted the Chairman-Director of the Commission, and occupy a highly salaried full-time position. He should be appointed for life, or until retiral under age limit. He should be assisted by his full-time chief engineer, who should also have a seat upon the Commission and a voice in its deliberations (that is, if the Chairman-Director did not act as Engineer as well). The other members of the Commission should be elected or appointed to represent the individual needs of the port in question, the constitution being upon the following lines:—

Chairman-Director.
Harbour Engineer.

One representative of each of the following:—
Foreign Shipping.
Home Shipping.
Coastwise Shipping.
Inland Water Transport.
Railway Transport.
Road Transport.
The Government through Ministry of Transport or Admiralty.
Port Labour.
The Municipality.

Six representatives of the Traders, appointed by Chambers of Commerce, Corn Exchange, Exporters' Association, etc., in accordance with the tonnage of trade passing through the port or the revenues contributed.

The members of the Commission should receive remuneration upon an attendance basis, but upon a scale suited to compensation for loss of time and expenses.. A measure of non-attendance would constitute a disqualification.

For the ports of very large size, a Commission similar in constitution to the Central Trust might be required, while for minor ports the number of members could be reduced. Small ports should be placed under the jurisdiction of adjoining ports of larger size, and operated as part of them.

The Chairman-Director—The Chairman-Director should be responsible for all matters of routine, discipline and adjustment, the intention being so to strengthen his position that he would be, for the individual Port, the final authority for all matters except those involving questions of policy, capital expenditure and questions of rates, or disputes involving considerable sums of money. He should be given complete jurisdiction upon all matters involving money of a sum below a figure to be pre-determined by the Central Trust, in accordance with the size and trade of the port which he was administering, and a clear ruling would have to be given as to what was within his competency. In this routine work he should receive the advice and assistance of his Commissioners. It is proposed that his powers should be akin to those of the Managing Director of a large Company.

The Chairman-Director would be appointed by the local Commission, subject to the approval of the Central Trust. In the event of a substantial majority of the Commission experiencing extreme dissatisfaction with his policy or abilities upon matters within his competence, they should have the right to appeal to the Central Trust for his removal, before whom he would have the right to appear. The Chairman-Director would carry out all matters of routine administration through the subordinate officials.

Conclusion

My proposals carry the natural evolution of Port Administration as it has developed in Great Britain one stage further to a natural conclusion, and combine in an essentially democratic organisation all the advantages which are found in a State Monopoly. Though the system is one nation-wide in scope, it is not Nationalisation as commonly understood, for the organisation would be substantially dissociated from the State and the influences of Party politics and the National Budget. The ultimately responsible authority would be, not the Minister of Transport for the time being, but what amounts to a small "Parliament of the Ports". I do not think that this would be an irresponsible body, and it naturally would depend much on the advice of the Ministry of Transport and its representatives who formed a part of its membership. Such a body would however be enduring, and would give to ports that continuity of policy and co-ordination of effort which is essential, not only to the well-being of the ports and the trade which they handle, but to the economic life of the country whose needs they serve.

Goole Pilotage Rates Increased.

The Humber Conservancy Board has adopted a recommendation by the Pilotage Committee that three additional Goole pilots be appointed, and that Goole pilotage rates be increased from 33 1-3 to 60 per cent. over schedule.

Floating Dock for Stockholm.

A floating dock of 7500 tons lifting capacity, constructed for Aktiebolaget Finnboda Varf, Stockholm, by the Furness Shipbuilding Company, Ltd., was recently launched at Haverton Hill-on-Tees. The dock is of the sectional box type and has been constructed to the designs of Dr. Salmon, of the well-known floating dock engineers, Messrs. Clark & Standfield, London.

Notes of the Month

Trade at the Port of Southampton.

In the first eight months of this year 425,000 tons of cargo were dealt with at the Southern Railway's Southampton docks. The export figures for 1946 show an increase of 12 per cent. over the corresponding period of 1938.

Bristol Docks Appointment.

Mr. Harold J. S. Young, M.Inst.T., has been appointed assistant general manager of the Bristol Docks undertaking. He has been in the service of the Port of Bristol Authority since 1920, and has served in most departments of the docks undertaking, acquiring a wide experience in traffic working and operating.

Sea Erosion Damage at St. Andrews.

A total expenditure of £3500 towards the scheme to repair sea erosion at the East Sands has been authorised by St. Andrews Town Council. The scheme is being jointly undertaken with the University authorities, and it was stated that the proportion of the cost to be met by the University will be much larger on account of the greater area of the University land to be dealt with.

Survey of Dry Dock Accommodation.

With the co-operation of port authorities, the Ship-building Advisory Committee recently carried out a survey of dry dock accommodation throughout the United Kingdom. The survey was effected by means of reports prepared by port authorities, and is to be the basis of all subsequent decisions to increase or improve dry dock accommodation.

Tour of Cardiff Docks by Overseas Students.

Under the auspices of the British Council, Overseas students at British Universities recently attended a vacation course at Cardiff on "Industry in South Wales." During the course, they visited Cardiff Docks and heard a lecture by Mr. W. H. Victory, General Assistant to the Chief Docks Manager, the subject of his address being "The Growth and Development of the Welsh Ports."

Coal Shipments at the Port of Blyth.

At a recent monthly meeting of the Blyth Harbour Commission in Newcastle it was reported that coal shipments from the port totalled 2,734,575 tons for the eight months of this year compared with 2,324,463 tons last year and 3,600,509 tons for the corresponding period in 1938. The figures for July and August showed a considerable improvement, but Foreign shipments are still at a very low level.

Navigating Upper Yangtsze.

The problem of transporting rice down the Yangtsze River rapids between Czechwan Province and the famine belt around Hankow, has been solved by recent experiments with United States Navy landing craft (medium landing ships). It is reported that despite the lack of navigational aids, one craft twice made the round trip between Hankow and Chungking successfully without damage to the cargo. On the basis of these experiments the Chinese Government are understood to be negotiating for the purchase of a number of surplus landing craft to be used on the Upper Yangtsze.

New Equipment for the Port of Copenhagen.

In order to improve the service for ocean-going traffic, the Free Port of Copenhagen authorities intend to build new warehouses and to acquire a number of new cranes. Recently, the port management visited British and Continental ports and ascertained that the best cranes for their purpose could only be procured in Great Britain. As the first stage of the new development, the Free Port authorities have ordered eight level luffing quay cranes from Stothert & Pitt, Ltd., Bath, one large derrick crane from Butters Bros. & Co., Ltd., Glasgow, and two super-mobile cranes from Ransomes & Rapier, Ltd., Ipswich. It is expected that other orders will follow as the traffic of the port increases.

London Port Changes.

The London Chamber of Commerce General Purposes Committee has decided to continue to press for a direct Government subsidy to the Port of London to enable port charges to be reduced. The Chamber's contention is that, as most of the goods coming into the port are for Government account, on which they are paying higher dues than those ruling in other ports, they are already giving an indirect subsidy.

Rehabilitation of the Port of Genoa.

It has been announced from Genoa that work has been completed on the reconstruction of the Boccardo, Gadda, Bettolo and Giaccone quays and the north side of the Molo Vecchio pier, the head of the Ponte Parodi and the San Giorgio pier. The four dry docks operated by the Ente Bacini are also repaired. With regard to unloading facilities, there are already 125 cranes in operation of the 250 existing before the war.

Danish Ships to be Equipped with Radar.

The first radar equipment in a Danish merchant ship has now been installed in the United Steamship Company's ship *Kronprins Frederik*. The company intends to equip other ships with radar as soon as possible, the *Kronprins Olav* being scheduled for installation in November and the *Parkeston* in December. The equipment is being delivered by Metropolitan Vickers, England, the price being approximately kr. 70,000 per set.

Anglo-Russian Trade Agreement.

As a result of the recent trade agreement with Russia, two vessels are already loading valuable cargoes of electrical and engineering equipment for the U.S.S.R. As soon as the agreement was made, Russian engineers and shipping experts were dispatched to this country to select the first consignments of machinery and supervise loading. The first shipments are being loaded at the Port of Middlesbrough and both ships are expected to sail very soon. Further consignments are to follow.

Fleetwood Dock to be Extended.

It is reported that, following a conference between the Minister of Transport, the Fleetwood Corporation, representatives of the fishing industry, and the London Midland and Scottish Railway Company, the owners of the dock, a scheme for extending Fleetwood Dock seawards is to be put into operation. Complete details are not yet available, but the extensions will be designed to give better berthing accommodation for the larger trawlers now being built for fishing in deeper waters, and by the alteration of the dock sill to enable larger draft trawlers to enter the dock.

Institute of Transport Awards.

The Council of the Institute of Transport has made a number of awards in respect of papers presented to the Institute during the year 1945-46 and outstanding performances at the 1946 examinations. Among them are: The Dock and Harbour Authorities Association Award to Mr. A. G. Course, Port of London Authority; the Dock and Harbour Authorities Association Award (for graduates and students) to Mr. S. Cox (student), Manchester Ship Canal Company; and the Sir Alfred Read Award to Mr. A. Watson, Chamber of Shipping of the United Kingdom.

Ship-to-Shore Telephone Facilities.

As from the 1st October, Ship-to-Shore telephone facilities, which were susupended during the war years, will be revived on a larger scale than ever. Before the war, the service was limited to large liners and the cross-channel ships fitted with radio-telephony, but, following war-time experiments and increased production in the system, most vessels, both ocean-going and coastal, will be fitted with radio-telephony. Four radio stations—Seaforth, the Humber, Cullercoats, and Port Patrick will link seamen with home exchanges. Charges are expected to be 10s. 6d. for the first three minutes and 3s. 6d. for every additional minute.

Use of the Cement Gun in Maritime Operations

Cement-Gun Repairs to Maritime Reinforced Concrete Structures, with Special Reference to the Town Quay, Southampton*

By JOHN PERCIVAL MASTERMAN PANNELL, M.B.E.,
Assoc. M. Inst. C.E.

Introduction

THE deterioration of reinforced concrete structures in sea-water has been the subject of frequent discussion in recent years and the published findings of the Sea Action Committee of The Institution have provided a comprehensive review of present knowledge of the subject

The repair of such damage may successfully be undertaken with the cement gun, an appliance for the projection of fine concrete at high velocity through a nozzle in a constant stream, the resultant material being known as "Gunite." By this means any thickness of concrete may be built up gradually on almost any structural material, including concrete of any age, steel, timber, and even strong paper.

The process has been increasingly used in Great Britain during the past twenty years, for both new work and repairs. As in all other constructional processes, repairs by gunite are dependent on good workmanship and materials under conscientious supervision. Provided that all these factors are present, the process offers a means of providing concrete which can exceed in bond strength and density that obtainable by any other means.

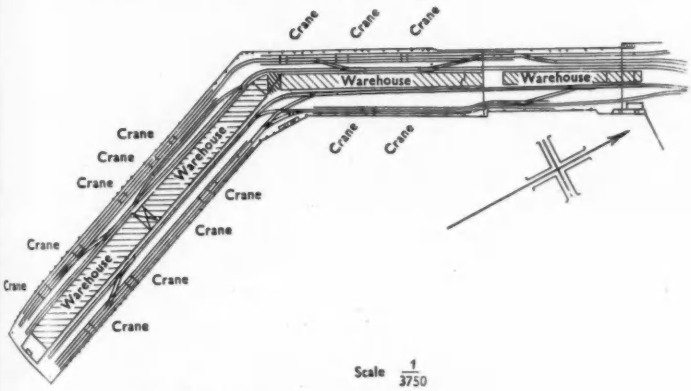


Fig. 1.—Town Quay, Southampton.

Some interesting results of tests on gunite structures were given in a Paper by Mr. G. C. Pearson, M.Inst.C.E.,[1] which shows, among other things, that the material develops a compressive strength of up to 10,000 lbs. per sq. in. after 7 days when using Leighton Buzzard sand in 3 : 1 mixture cubes.

In 1935, the Author was faced with the problem of repairing serious deterioration to the reinforced concrete portion of the Town Quay, Southampton. Previous attempts at repair by trowelling or by cutting out and re-casting the defective portions had proved failures. The Southampton Harbour Board, owners of the property, on considering the Author's recommendations, decided to carry out the repairs with the cement gun.

Work was commenced in 1936 and continued during the summer months of each year until 1940, when operations ceased owing to call-up of the trained personnel.

It is now possible to examine the repairs after the lapse of from 5 to 8 years, and the results are incorporated in this Paper.

*Paper read before the Maritime and Waterways Division of the Institution of Civil Engineers and reproduced by permission.

[1] "Repairs to Reinforced Concrete, by Cement Gun Method," Midland Assoc. Gas Engrs. and Managers, Autumn General Meeting, 26 Oct., 1933.

History of Original Construction

The Town Quay, Southampton (Fig. 1) is an open piled jetty extending seaward from an ancient quay of the fourteenth century. The original piled extensions were constructed in stages during the second half of the last century and consisted mainly of cast-iron screw piling supporting a timber deck construction. The last extension, in 1893, was of similar piling supporting a steel joist and trough deck superstructure, in which form it still remains, though somewhat damaged by enemy action.

The cargo handling equipment of the quay was improved in 1893 and 1895 by the provision of six electric portal cranes which, when added to the existing railway traffic, called for some strengthening of the older portions of the structure. In addition, the warehouses, which consisted of single-storey sheds, were inadequate for the growing traffic.

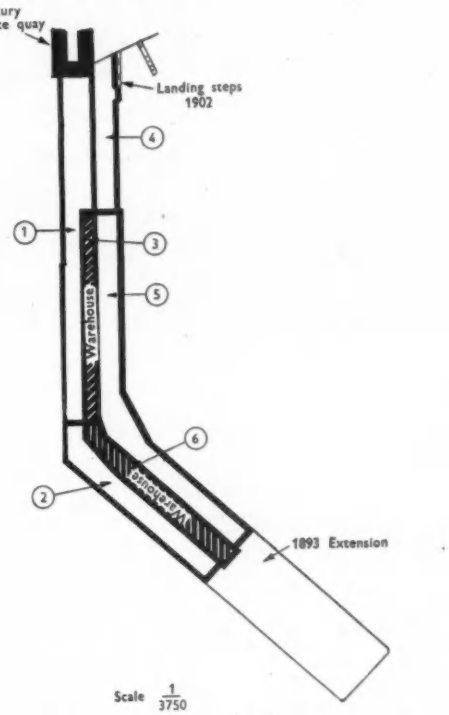


Fig. 2.—Construction Contracts Town Quay, Southampton.

Having regard to these factors, the Southampton Harbour Board undertook a programme of reconstruction in reinforced concrete over a period from 1902 to 1915. The greater part of this work was carried out by a series of six contracts involving a deck area of about 140,000 sq. ft., with two warehouses of two storeys each, landing steps, etc. (Fig. 2).

The greater part of this work is substantially sound to the present day, but, in common with most similar structures, certain portions have suffered severely from the ravages of sea, air and water.

Before the main reconstruction programme was commenced, a small landing steps structure was rebuilt in 1902, by the Hennebique process. Following this, the first principal contract

Use of the Cement Gun in Maritime Operations—continued

was let in 1904. Referred to as Contract No. 1, it covers an area of 30,000 sq. ft. and was constructed under the Hennebique system.

In the light of knowledge existing at the time, the work was well executed. Cover, as provided in the drawings, of from $\frac{3}{4}$-in. to 1-in., was as a rule maintained. The concrete throughout was carefully placed and tamped, and much of it has proved to be impervious to sea air for more than 40 years. The failures in this contract have been almost entirely due to the effect of sea-water between just below the level of high water of neap tides and a foot or so above high water of spring tides and consist of the breaking away of cover at corners of 14-in. by 14-in. piles and 12-in. by 9-in. bracings, followed by a later partial uncovering of the sides. All the piles and bracings have suffered in this way, as may be seen in Fig. 3. The beams, both longitudinal 12-in. by 9-in. and transverse 10-in. by 8-in., are 80 per cent. good, and the defects in the remaining 20 per cent. indicate that the concrete had an excessive water-content, as the steel appears to be well placed and the finished work is homogeneous.

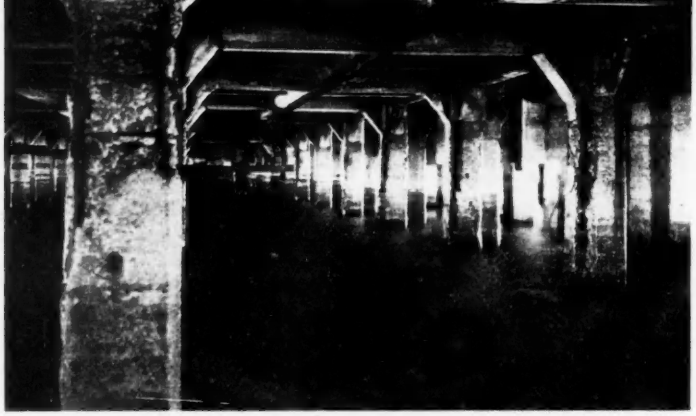


Fig. 3.—General Range of Corrosion in Piling.

Number 2 contract, of 17,000 sq. ft., is an engineering curiosity, incorporating many unorthodox features, some of which were advanced at the time (1906). With the exception of an outer row of 14-in. by 14-in. piles, the structure is supported on columns utilising the cast-iron piles of the previous structure as foundation. Around these piles were erected permanent casings of pre-cast slabs with interlocking corners supported on vertical steel angles at each corner. The spaces between the slabs and columns were filled with mass concrete, forming a column 18-in. sq. Built into the top of these columns are transverse beams 27-in. by 12-in. in section, reinforced by the Kahn system. These beams carry the main deck, which is formed of narrow pre-cast slabs laid longitudinally.

The pre-cast casing slabs are of uniformly high quality and even now they show only a few rust spots where the $\frac{5}{16}$-in. diameter reinforcing wire has insufficient cover.

The site-cast transverse beams, however, are of poor concrete and the soffit of each beam has burst across the line of minimum concrete section. (Figs. 4 and 5). The concrete below this line shows effectively how the steel has prevented tamping and it is evident that very wet material has been used in an endeavour to pass the material through the narrow spaces between the bars.

Contract No. 3 covers the construction, by the Hennebique system, of a two-storey warehouse, including piling and deck. Although built in 1908, the building, as a whole, has withstood the effect of sea air, the piling having been penetrated by sea water only from half-tide to high-tide level.

A small portion of the quay, constructed in 1910 (Contract No. 4) using, where applicable, the Coignet principle, utilises the original cast-iron piling to a large extent, the reinforced concrete being supported on specially designed caps fitted to the pile tops; 14-in. by 14-in. diagonal bracings are cast around the iron piling. This bracing has been penetrated from half-tide up and there is also considerable deterioration of the 16-in. by 8-in. secondary beams of the deck. The 18-in. by 10-in. main beams have been affected only slightly.

The next contract (No. 5) was let in 1911 and covered 35,000 sq. ft., the remainder of the waterside portion of the scheme. Of sound design (Henebique), the construction was not good and introduced an additional defect common throughout the whole contract, namely, failure to make watertight concrete at the construction joints. This feature is very pronounced and takes the form of lack of bond between successive pouring of concrete immediately above the joint faces. Figs. 6 and 7 show the quantity of defective material cut away at such a joint.

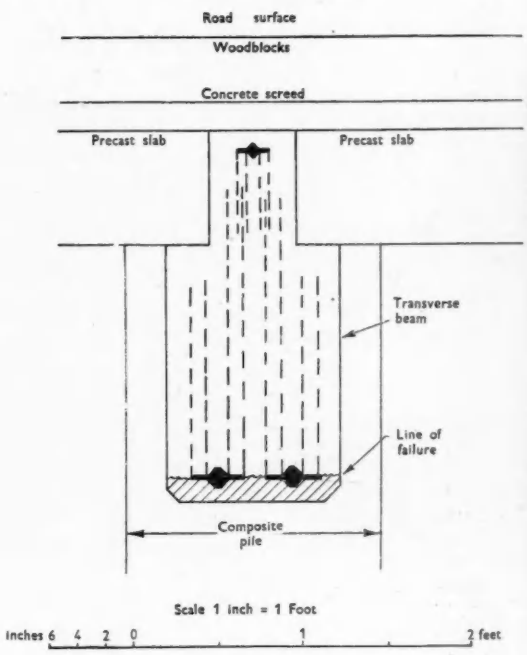


Fig. 4.

Contract No. 6 covers a warehouse similar to No. 3 and the deterioration is much the same as in that construction.

For a period of about 25 years an electric crane installation was working on some parts of the quay, having a 200-volt potential with earth return through the crane rail. In spite of this, however, some parts of the structure without crane services have suffered the worst deterioration. This appears to indicate that electrolysis through stray currents from the crane system was not contributory, but that electrolysis through internal action between the reinforcing bars subject to moisture through porus concrete has been a very probable accelerator of corrosion. In the Author's opinion, commercial grades of steel do not possess sufficient uniformity to ensure absence of electrolytic action, even between different portions of one bar, and certainly not between two bars or bar and stirrup or binding wire of different batches of steel.

The defects observed throughout the structure agree, in all respects, with those described by Sir Leopold Savile, K.C.B., Past-President Inst.C.E., on page 40 of his report published in the Fifth (Interim) Report of the Sea Action Committee of The Institution. The limits of deterioration are indicated on the tidal curves in Fig. 8.

Proposed Method of Repair

Inspection of the general lay-out of the Town quay (Fig. 1) will show that unless the normal working of the undertaking is to be seriously interfered with, little space is available for plant,

Use of the Cement Gun in Maritime Operations—continued

materials, or the various incidentals to a large construction contract.

After a comprehensive survey of the condition of the structure, it was evident that the deterioration, although severe in places, actually affects a small proportion of the quay as a whole. Any satisfactory method of repair, even if high unit cost, would, therefore, result in large savings in comparison with any form of reconstruction.

It was considered that the work should be done only during the summer season, having regard to the draughty conditions between the underside of the deck and the water-surface, which were not conducive to good workmanship and would probably have caused excessive absence through illness. Season work elsewhere effectively occupied the labour in the winter.

Having regard to these factors, the Southampton Harbour Board, on the Author's recommendation, decided to purchase the necessary plant and undertake the repairs by direct labour, the work to be spread over a number of years.

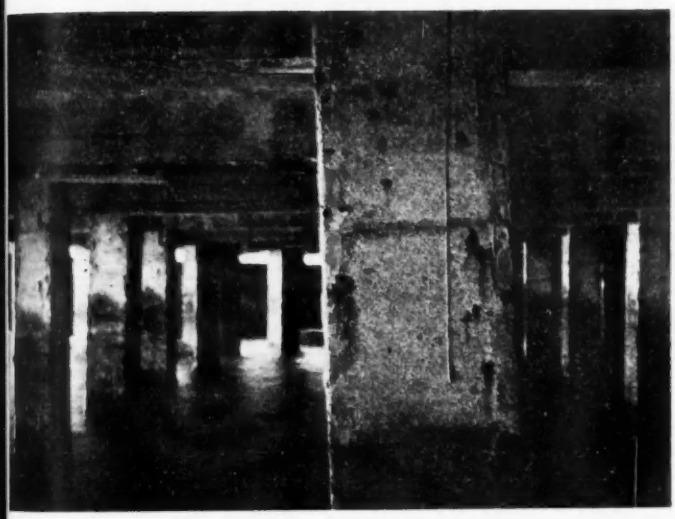


Fig. 5.—Line of Failure in Beams and Interlocking Pre-cast Slabs Enclosing Cast-iron Piles.

Personnel Employed

The team engaged on the work was small numerically, but each man was selected by trial and elimination until all worked together as a unit. It consisted of a charge hand, a nozzleman, a cement-gun operator, a mate to nozzleman and two labourers for mixing. The same individuals cleaned the old work, fixed reinforcement, and shifted staging.

The initial instruction was given by a superannuated foreman who had been engaged on a number of gunite contracts and was temporarily employed as charge hand for the first season. A good working charge hand is necessary to exercise constant supervision over such items as erection of staging, cleaning old work, fixing of reinforcement, mixing, and gunning.

When the work is recommended it is intended to allocate labour as follows: 6 mean as above; 3 shifting staging; 3 cleaning old work and fixing reinforcement. By this means the machines will be more fully occupied and some of the arrears due to the war years will be overtaken.

Plant and Tools

The plant used on the work comprised an air-compressor; cement-gun placing-machine; cement-gun nozzle; air-hose, compressor to gun; material-hose, gun to nozzle; water-hose, main to nozzle; three "pistol"-type pneumatic hammers; screens; gauge-boxes, 8 cub. ft.; wire-cutters and pliers; staging and ladders; "flats."

Air-compressor: Electric drive was chosen for the air-compressor as a power-supply of direct current at 400-volts is available, with numerous socket outlets at convenient points and, in addition, the Board's mechanics are more conversant with the maintenance of electric plant. Although the machine is tied to work in the vicinity of a suitable supply, the choice was a good one as stoppages through compressor trouble have been negligible. Incidentally, the temptation to remove the compressor to other works was effectively neutralised—to the advantage of the gunite repair programme!

The machine is a Broom and Wade type S.V. two-cylinder sleeve valve single-stage compressor, having a piston displacement of 199 cubic feet per minute and an air-delivery of 170 cubic feet per minute at 100 lb. per square inch pressure.

The drive is provided by a 40-horse power Crompton motor connected by heavy cab-tire sheathed trail cable to a standard crane plug for connection to the mains outlet socket. The safety valve and governor of the compressor are set to 75 lb. per square inch; this pressure is a compromise, being the maximum safe

Fig. 6.—Typical of Necessary Cutting Away at Construction Joints.

pressure for the cement-gun and sufficient for the working of chipping hammers.

When supplied, the air-receiver of the compressor was provided with a manifold having four outlet cocks to take ¾-inch hose. The demand of the cement-gun cannot be met by a supply of this size and therefore a 2-inch wheel valve was fitted in place of the screwed plug at the manifold end.

No moisture separator was fitted in the air line; a periodical blow-down of the air receiver effectively dealt with accumulated oil and water.

Cement-gun and placing-machine.—The cement-gun used was Type N-2 of the Cement-gun Company, which is suitable for placing any grading of material up to a maximum size of ⅜ inch (Fig. 9). This machine provides means of feeding a dry mixture into the compressed-air system at a constant rate. It comprises an air-lock system of two conical chambers, one above the other, each having a cone or bell valve at the top. These valves are controlled by handles on the outside. Revolving on a vertical axis at the base of the bottom chamber is a feed wheel which has on its periphery openings for measuring regular portions of the mixture into the material hose. This feed wheel is driven by a compressed-air motor through worm gearing.

Provision is made for opening up the working chamber for clearing obstructions from the feed wheel. There is also an additional connection for the material hose whereby the full air-pressure may be used for clearing obstructions in the hose.

The cement-gun may usually be placed near the compressor, and this has been the case throughout the works on the Town Quay; therefore, the air-hose may be short.

Use of the Cement Gun in Maritime Operations—continued

The material hose is of 1½-inch bore and is provided in 50-foot lengths. For a great proportion of the work a length of 100 feet has been sufficient, but no difficulty has been experienced in working with twice that length.

Water-hose of ½-inch bore is required and has been connected through standpipes to hydrants in the quay mains. The hydrants are at approximately 200-feet intervals along the faces of the quay.

The nozzle (Fig. 10) is provided with an annular ring drilled

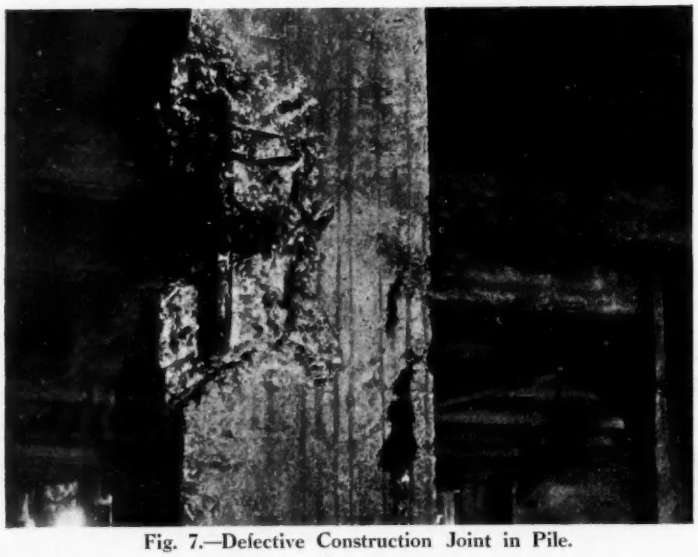


Fig. 7.—Defective Construction Joint in Pile.

with a number of holes through which the water passes to hydrate the mixture immediately before leaving the nozzle mouth. The type of nozzle used on the work has a rubber lining which can be replaced without difficulty when worn.

Chipping hammers.—Light chipping hammers have been sufficient for most of the scaling. Their use was preceded by hammering the members to be treated with a heavy sledge-hammer which removed the bulkier portions of loose concrete and rust.

The screens used were of a square mesh; the normal type of screen, having long narrow openings, were found to pass elongated objects such as nails, which cause trouble through fouling the feed wheel in the gun.

Staging.—The staging for the under-deck work was supported on a timber framing of 4½-inch by 3-inch material clamped by long bolts to the piles. On these timbers scaffold planks were secured by standard scaffold wires. This staging was erected from "flats" or square-ended flat-bottomed boats. The narrow spacing available between piles and bracings in some parts of the structure necessitated the building of two specially narrow flats.

Materials

Aggregate.—The aggregate used throughout the work has been local washed shingle ranging from ⅜ inch to fine. When delivered, this material was stored under cover until fairly dry. Absolute dryness is not essential; in fact, it is conducive to loss of cement in handling. The aggregate is screened once before mixing.

Cement.—Ordinary Portland Cement has been used for all parts of the work. It has been found that gunite deposited at half-tide-level and above is resistant to wave action of the degree likely to be encountered when conditions are fit for working under the quay deck.

Mixture.—The mixture used throughout the work is approximately 1:3, measuring being by 8 cubic feet of sand to two bags of cement in each batch. This dry mixture is turned over three times and is finally screened before being fed into the hopper of the cement-gun.

Reinforcement.—Reinforcement is necessary to prevent shrinkage cracks in the gunite. In some early works expanded metal was used for this purpose, but the tendency for rebound sand to gather in awkward corners is aggravated by the pattern of this material. Square welded mesh offers little obstruction at the intersections and has proved very satisfactory. The size used throughout the repair of the Town Quay has been 3-inch by 3-inch mesh of 3/16-inch mild steel wire, delivered in flat sheets 16 feet by 7 feet; the sizes and shapes required are cut out with double-level wire-cutters.

Preparation of Old Work for Repairs

Early work with the cement-gun frequently failed through non-recognition of an essential factor for success, namely, the elimination of all cracked, porous, or defective concrete and the cleaning of reinforcement to a mill surface. Mention of such unsuccessful attempts is made in the Tenth (page 41) and Eleventh (page 19) Interim Reports of the Institution Committee on the Deterioration of Structures in Sea-Water.

As these reports indicate, it is futile to flash coat any old work with gunite, as the corrosion of steel will not be checked and subsequent increase of bulk will cause the steel to crack any thickness of covering gunite.

The first move in the attack on damaged work is to knock away all larger portions of the old work which are seen to be loose or cracked. The use of a sledge-hammer is usually effective in removing the big stuff, after which pneumatic hammers will clean off smaller pieces and the bulk of any rust from the reinforcement. Quite small pistol-type hammers are effective for this portion of the work; the chisels should be secured by thongs or by any of the patent devices to avoid frequent loss into the tide.

Following these preliminary measures, the final clean-up should be by wet sandblasting. It is a fortunate circumstance that the equipment may be used with good effect in the preparation of the original construction. By the omission of cement, the air-projected sand-water mixture used as a wet sandblast is very efficient in removing all loose particles left after preparation by hammering. Rust is cleaned from the reinforcement, which is left with a mat finish entirely suitable for the placing of new material.

When rebound sand is recoverable, it may be used for sandblasting. On maritime work, however, it is necessary to provide

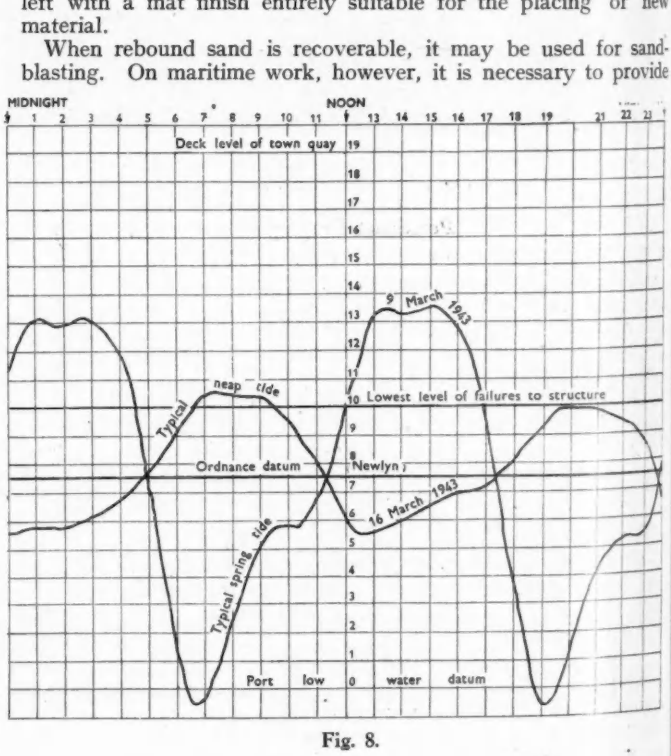


Fig. 8.

additional sand for the purpose, as most of the gunning will be over water.

Cleaning by wet sandblasting should include sufficient of the undamaged faces of the original work; this will ensure that any feather edges of the new work bond satisfactorily. If the cleaning

Use of the Cement Gun in Maritime Operations—continued

is not sufficiently extended, such flashed edges will break away, leaving re-entrant corners which increase liability to future failure and also produce unsightly work.

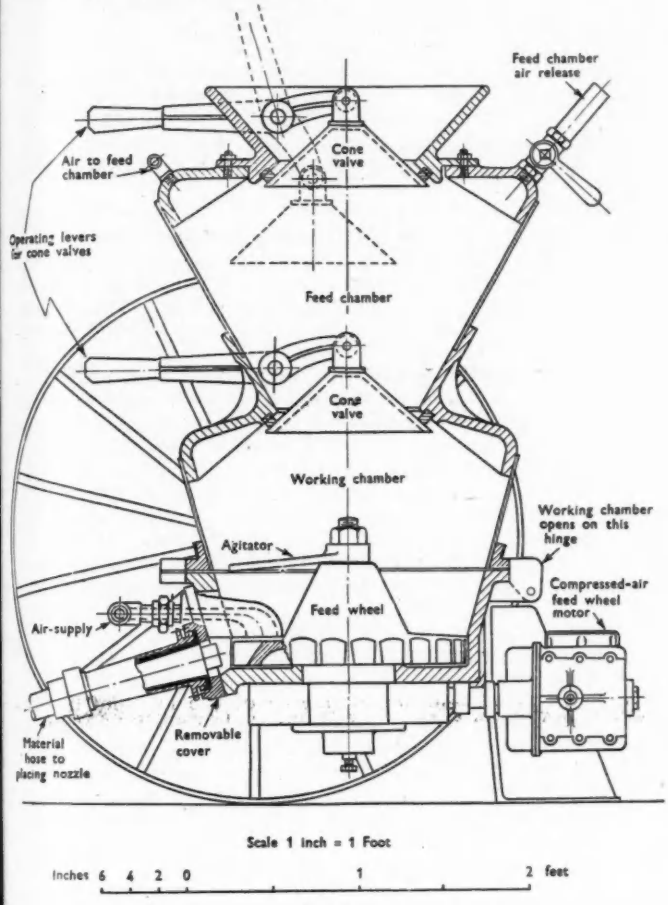


Fig. 9.

Fixing Welded Mesh Reinforcement

The type of welded mesh recommended is very adaptable and may be cut and shaped easily to fit the form of beams, struts, and junctions of structural members.

Where a lap was required, the normal 3-inch pitch was generally used and the overlap was wired with 14-gauge iron wire at such intervals as to ensure permanence of form. The mesh reinforcement should be separated by about ¼-inch from the parent work and secured to the original reinforcement by wiring at fairly close intervals.

Working Procedure by Gun Operator

A working cycle is commenced with a clean and empty placing-machine, with the compressor running and all hoses connected. All cocks are closed and both chambers filled, and while the loading is being done the final cleaning of the surfaces is being finished by the nozzleman with the nozzle, using air and water.

The compressor is regulated to 75 lb. per square inch, which is the maximum safe pressure for the placing-machine and is sufficient also to operate the pneumatic hammers for cleaning.

The pressure in the working chamber is regulated to 25-30 lb. per square inch for one or two lengths of hose; a higher air-pressure will increase the rate of deposit, but the reaction is greater and the results of fatigue on the nozzleman will probably reduce the overall progress and also lower the standard of workmanship.

When both chambers are filled and the nozzle operator signals his readiness, the air-pressure to the material hose is turned on, followed by the starting of the feed-wheel motor. This sequence is necessary to reduce the risk of chokes in the material hose.

When the nozzle is running free, the working cycle lasts from about 3 to 4 minutes. The feed-chamber contents are checked by the operator feeling the weight on the lower cone valve handle, and when this indicates that the feed-chamber is empty he opens the air-release cock, whereupon the pressure in the feed-chamber falls to atmospheric and the top cone valve opens by its own weight. The feed-chamber is then filled, the top cone valve is closed, the air-valve is closed, and the air inlet valve to the feed-chamber is opened. When the air-pressures balances between the two chambers, the lower cone valve opens under the weight of material. When this takes place the top chamber air inlet should be closed to prevent high air-pressure building up from the compressor. Repetition of this cycle is continued for as long as the nozzle operator can conveniently use the incoming material.

The gun must be emptied of material and blown through while the air motor is kept turning. When loading is stopped, the material hose is unscrewed from the working chamber and connected direct to the air-line by a connection provided for the purpose of blowing out the hose.

Stoppages in the material hose or the feed wheel may be due to large stones, nails, or similar foreign bodies, pieces of paper from bags or pieces of cord, any or all of which may form a conglomeration similar to that found in sink or drain traps. The remedy adopted on the works described was to screen the mixture finally before loading it into the hopper. Clearing of stoppages in the hose may be achieved by connecting the hose to the main air-supply in order that the higher pressure shall clear the obstruction; beating the hose also assists the break-up of obstructions. Stoppages in the feed wheel necessitate opening up the gun and may, therefore, cause appreciable delays.

Operations by the Nozzleman

The key man of the whole team is the nozzleman. Working as he does from staging or " flat," under draughty conditions, and controlling a process needing both skill and stamina, his fitness for duty is of primary importance and the provision of protective clothing and equipment, may be considered a sound investment. He should exercise some supervision over the fixing of mesh reinforcement, as his practised eye can detect potential traps for rebound sand.

Following the cleaning operations, he proceeds with the immediate deposition of gunite, the dry material being turned on at his signal, whilst he turns on the water supply which is regulated until the work assumes a greasy appearance; dryness is evident through dry patches. Excess water is driven out of the mixture by the tamping effect of the nozzle velocity and runs off the face of the deposited material. Gunite is, therefore, a concrete having

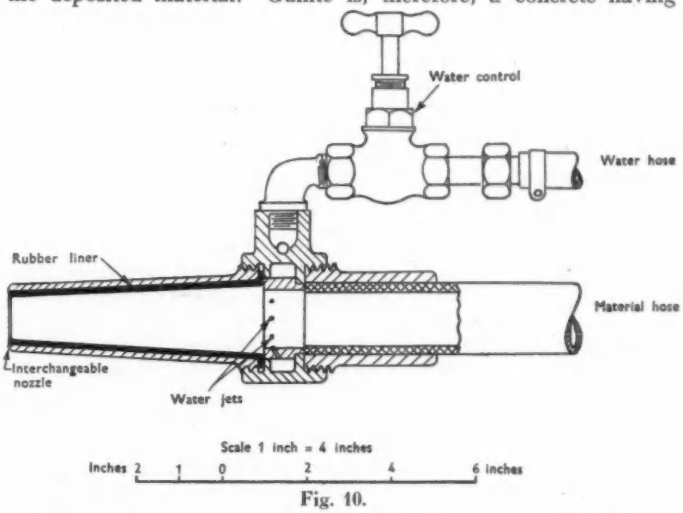


Fig. 10.

virtually zero slump and vibrated as a natural result of its own deposition.

The Effects of "Rebound"

The rebound of sand from the hard parent surface results in a variation in the sand/cement ratio throughout the first ⅛-inch or

Use of the Cement Gun in Maritime Operations—continued

3/16-inch thickness of the deposited material. This feature, which probably adds greatly to the bond strength of gunite, may be described as follows:—

The normal 3:1 hydrated mixture, passing through the nozzle, is shot with a high-velocity on to the cleaned parent surface. On impact, the hard sand particles rebound leaving the cement, which

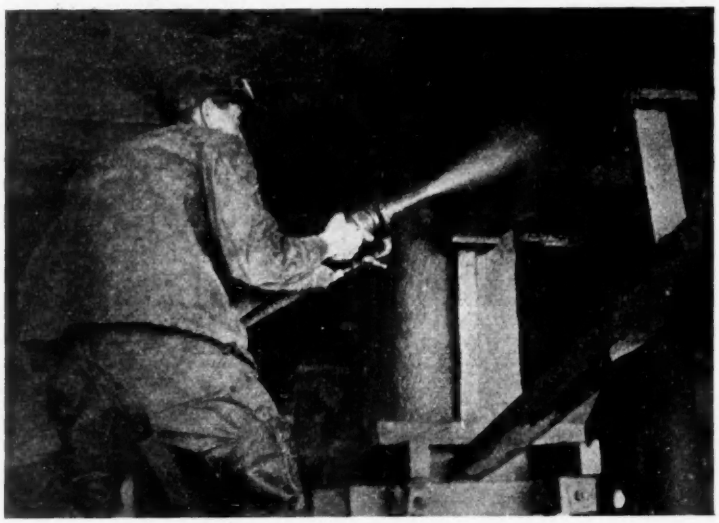


Fig. 11.—Cement-Gun Nozzle at Work. Town Quay.

forms a matrix. As the cement matrix thickens, sand of increasing size is held until, with a thickness of $\frac{1}{8}$ inch or so, the whole of the sand is held. Beyond this thickness the mixture is the normal.

The rebound sand, being free of cement, can cause weakness if trapped and allowed to form pockets within the fresh deposit. The use of elaborate formwork for the purpose of imitating the normal concreting practice will increase the risk of such sand-pockets. In repair work, such as that described in this Paper, satisfactory results may be obtained in most cases without any shuttering. The appearance of a gunite finish, with rounded external and internal corners, gives a sense of fitness for its purpose which is sometimes missing in more angular work.

It has been found possible to locate sand-pockets of such size as to constitute serious defects in the gunite deposit. A hammer test on the hardened work results in a hollow sound at the location of such rebound sand, which may be cut out and replaced with normal gunite.

Rebound can be avoided in normal work by shooting at an angle of approximately 90 degrees to the face of the parent structure, the nozzle being kept 2-3 feet from this face (Fig. 11).

Cover

A thickness of 2 inches is as much as should be built at one time; greater thicknesses, if necessary, may be added in further stages. In the opinion of the Author, the density of gunite is such that 1 inch of cover in well-deposited gunite is adequate protection against sea-water. This cover should be ensured by gauging the position of the mesh in relation to the original face of the work; the finished face of the gunite will probably be somewhat proud of that face. No attempt need be made in the case of structures of the kind under consideration to finish the work to square corners. (Fig. 12).

Present Condition of Repaired Work

The first gunite repairs to the Town Quay were carried out in 1936, so that sufficient time has passed to indicate the quality of the work and its effectiveness in withstanding sea-water conditions. The repairs are not perfect, but are sufficiently good to be considered successful. Throughout the whole of the work so far done, about 90 per cent. shows no defect whatever, whilst the faults in the remaining portions are not serious but serve to indicate lines of improvement possible in future work. The gunite process offers the great advantage of easy cutting out and repair of defects in work done by the process itself. In this respect it is akin to welding; in both processes also, the detection of faults is more difficult than their repair.

Of approximately one hundred of the beams in Contract No. 2, of which the soffit had been built up with gunite, three show cracks on the line of the original reinforcement. In each of these cases, upward of 2 inches of gunite was deposited at one "shoot" and, in the Author's opinion, the cracks are due to failure of the deposited material in the inverted position, due to its own weight. More recent work has been deposited in 1-inch layers in such positions.

A few of the repaired patches show rust marks due to rusting of the mesh reinforcement or projecting portions of the binding wire. This occurs particularly on the rounded corners of piles and struts where the operator may have a tendency to skimp the cover. These spots may be cut out, cleaned, and re-gunned. The remedy, in future work, will be to gauge the cover, using the original surface of the structure as a datum.

Some small patches which were cut out and repaired without mesh have cracked through shrinkage, and it is evident that even a small repair must have reinforcement applied, even if this means a considerable increase in the area covered with gunite.

The finish of the " flashed " edge, where the repair merges into the original work, has been spoiled, in many cases, through insufficient cleaning and subsequent spalling of the feather edge. Gunite will bond effectively, no matter how thin the layer, if the parent material is clean and, although the degree of spalling is not harmful, the work will be improved by extending the cleaned surface, or by taking care to flash off within the sand blasted area.

Guide to Estimating Costs

Repairs to structures in maritime use are inevitably difficult to assess in terms of costs which will be of use in estimating for future works, even under apparently similar conditions. Each unit reconditioned, whether beam, strut, or pile, offers an individual problem and the cost per unit may vary widely.

Work of this nature, however, includes many items which are more or less constant, such as staging, plant depreciation, and so on. These will be found to form a considerable proportion of the total cost. In addition, it will frequently be found in jetty works

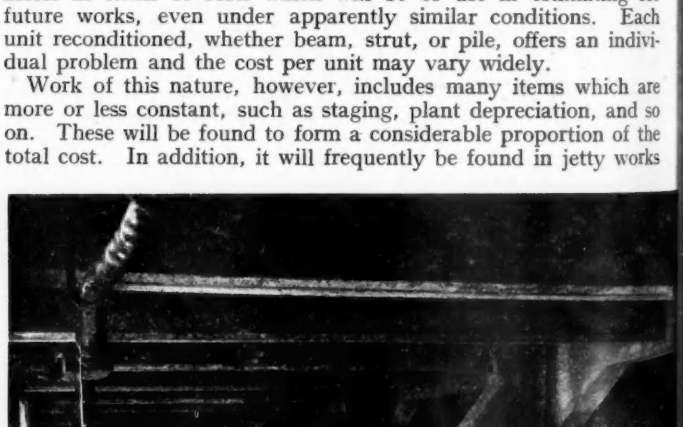


Fig. 12.—No. 8 Berth, Town Quay, Repairs by Cement Gun, October, 1937.

that the outer and more accessible bays are complicated by the provsion of raking struts, whilst the bays farther from the berth face are free of these but call for longer runs of hose and other compensating factors. All these considerations preclude the use of a costing system based on area or volume of material placed; by taking units of deck area of the structure under consideration,

Use of the Cement Gun in Maritime Operations
(continued)

some figure will be reached on which reasonable reliance may be placed.

In the present case, the cost of each season's work has been calculated on the basis of superficial feet of deck-area of the structure affected, including labour, material, and plant depreciation. In the 1936-1939 period this cost worked out at between 10½d. and 1 shilling per superficial foot. In comparison, the reconstruction in slightly heavier sections of reinforced concrete of a portion of the 1893 quay cost, in 1938, complete with rails and crane track, £1 2s. 6d. per superficial foot.

Acknowledgment

The Author wishes to acknowledge the help and encouragement given by Mr. M. G. J. McHaffie, M. Inst. C.E., Chairman of the Works and Harbour Committee of the Southampton Harbour Board, and by Mr. E. E. Mann, M.Sc., Assoc. M. Inst. C.E., of University College, Southampton, who read and criticized the original draft Paper.

Clyde Navigation Trust

Chairman's Review of Work in War Period

A review of the work performed and the results achieved by the Clyde Navigation Trust during the war was given by the Chairman, Mr. James Leggat, at a luncheon in Glasgow on September 10th last. It is an amplification of the earlier review made in June, 1945, by the late Chairman, Mr. William Cuthbert.

As reported in the *Journal of Commerce*, Mr. Leggat, in the course of his survey, said that since last they were together in 1938 much had happened. They were proud, he thought justly proud, that the war effort by all on the Clyde was of vital worth in the struggle, and it was right that he should give a few facts worthy of notice.

At an early period of the war it was evident that the Clyde and the Mersey were to be the key ports in the Battle of the Atlantic, and that their capacity had to be increased. At Glasgow both berthage and handling facilities were improved as priority schemes. The civil and mechanical engineering work involved was extensive and exacting, and the cost of about £2,000,000 indicated its extent.

Quayside Equipment

Mr. Leggat then went on to describe some of the work which had been achieved. Glasgow, he said, had over 12 miles of quays reasonably equipped to meet demands as they were before the war, but the King George V Dock, the largest and deepest, was equipped only on the east side. The west side had not been equipped, and it had to be decided whether to do so or to meet the known local preference for up-river berthage and build at Meadowside of the site previously occupied by Patrick Sawmills. There was war advantage both as to time and capacity in equipping the west side of the King George V Dock, and that was done. Cranes, rails, sheds and a large reception yard were provided and used to the full.

Notable work was done there, special features being the timber handling, the receiving of assembled aeroplanes and their despatch over the old Renfrew Road to the nearby aerodrome. That last move was unique in this country and of tremendous value to the war effort.

Later, to simplify the passage of large new warships from Fairfield's yard, the projecting land near Meadowside Light was removed and a quay wall constructed, joining the Meadowside and Merklands Quays. The trustees also approved the placing of dolphins by the Petroleum Board on the north side of the river channel to the west of Dunglass for the berthage of tankers. A connection by pipe lines to the Bowling depot was made and again this proved to be of great advantage.

Before the war, cranes had not been required at all berths. During the war, however, cargo cranes were added at the King George V Dock, Plantation, Prince's Dock, Queen's Dock, Merklands, Rothesay Dock, and heavy cranes at the graving docks. In all 48 additional cranes were installed and 15 of the older cranes improved. Those cranes, with new mobile cranes and trucks, an additional pneumatic elevator at Meadowside Granary and Ministry of Transport floating cranes, immensely increased the capacity of the port. Glasgow handled over 90 per cent. of all Clyde cargoes, the tonnage of goods being about 50 millions. War experience had shown the value of up-to-date crane, rail and handling facilities and the case for their continued use seemed clear.

Storage Difficulty

At early meetings in London it was stressed on behalf of the trustees, that if Glasgow had to tackle increased traffic at high speed, storage would be a serious difficulty and that, therefore, the early acquisition of stores or their construction was necessary, as were transport depots to expedite clearance of the quays. Although there was at first some difficulty in obtaining Government approval for those depots, they were approved, and Glasgow was the first to have them. They were at Deanside and Braehead, on land belonging to the trust, and with their 18 miles of railway sidings covered 80 acres. It was the intention of the trustees to negotiate with the Ministry of Transport for their acquisition.

Labour Schemes

Dock labour was naturally of great importance during the war, and schemes for the Clyde and Mersey had given to the dockers a guaranteed wage on stated terms. Those schemes still operated but arrangements for the future had yet to be settled. It was essential that a wise solution should be found so that the best was made of ships and port facilities with fair earnings and conditions for the dockers.

Ship construction, conversion and repair were also of vital importance and it was encouraging to know from official figures that Clyde firms, chiefly those in the trustees' section of the river, carried out over 27,000 main contracts during the war. Those contracts included 1,549 new naval vessels, 354 new merchant ships and repairs to 25,687 vessels. They were impressive figures, and included the largest new ships afloat.

There was a time before February, 1941, when certain records were not available, but what had been said would show the unique part which Clyde shipbuilders and repairers played. No part of the country could equal it, and throughout the war years official parties visiting the Clyde were greatly heartened and astonished by what they saw. Enemy damage fortunately never appreciably impaired the capacity of the port and the £400,000 which the trustees had expended on A.R.P. had had good results.

Tribute to Pilots

Dealing with the work of the pilots, Mr. Leggat paid special tribute to the Clyde Pilotage Authority and its officials. In 1939 the staff of pilots was 50, but during the war it had to be raised to no fewer than 126, by the transfer of Trinity House pilots and by temporary appointments. The good work at the Clyde Anchorage Emergency Port owed much to the pilotage authority, its officials and the pilots. Over 200,000 acts of pilotage, sometimes 300 a day, were completed on the Clyde, and the pilots moved over 500,000,000 tons of ships without serious mishap, although there was a regrettable collision between a ship launching and one inward bound. Fortunately there was no loss of life and repairs were speedily finished.

"For the future of our harbour and the surrounding industry," he concluded, "I have good hopes. You are seeing to-day, in the yards, that Clyde shipbuilders maintain their pre-eminence. Our shipowners and merchants, in this time of high costs and many uncertainties, are going forward with the same courage and enterprise which have made our great maritime trade.

"In the Clyde Trust we shall endeavour to provide, as our predecessors provided in the past, an efficient and attractive harbour, allowing ships to bring their cargoes close to the heart of our great city at the lowest economic cost. I am optimistic, provided all realise now, and not when it is too late, that the rewards can come only to those who work, work hard, and work steadily."

Decasualisation of Dock Labour

(CONTRIBUTED)

For as long as one dares to remember, the dock worker has been treated like an old coat, taken off the peg and used when required, with the result that there has been continued dissatisfaction and seething unrest on dock-side over a great many years.

Strikes, both official and unofficial, have paralysed the docks and waterways of this country time and again since the great Dock Strike of 1889. The Trade Unions and the employers have been in constant conflict across the table and hard bargains have been forced, by both sides, on rates of pay and working conditions. Numerous enquiries into the conditions in dockland have from time to time been sponsored by the Government and on each occasion the inquiry has resulted in improved conditions because the dock industry has been, and always will be, recognised as one of the most vital industries of the country, and efficiency is essential if this country is to hold its place in the world markets.

For years the industry has been on a casual basis, holding thousands of men far in excess of requirements; men who could have been used more profitably in other industries, and their average employment was 2 to 3 days a week.

The Shaw Report in 1920 recommended the setting up of Registration Committees in all the ports of the country; the object then was an endeavour to restrict the number of men available for employment. The Court also approved the principle of maintenance of men who follow the docks for a living.

The Unemployment Insurance Act was extended in 1920 and the Dock Worker was brought within its scope. When not employed on dock-side they signed on at the Labour Exchange twice a day and in order to obtain benefit they had to sign the book on any three days within six. Whilst this was certainly an improvement in the dockers' standard of living, it had its faults. The docker frequently only employed for half a day or one day at a time, was reluctant to accept—having already been employed for three days—half a day's work for which he might only receive 6s. and run the risk of forfeiting benefit at the Labour Exchange, and what was known as " three on the hook " and " three on the book " became common.

The Dock Strike in 1924 brought a promise that a further enquiry into the claim for maintenance would be held. Then followed the " Maclean Enquiry " in 1925 and its subsequent recommendation for the re-organisation of the Port Registration Committees. This was followed by a further enquiry also under the Chairmanship of Sir Donald Maclean in 1931, set up to enquire into the employment and unemployment in the port transport services and to make recommendation with special regard to decasualisation and the administration of the Unemployment Insurance Scheme.

Following these two enquiries an important step in the right direction was taken in September 1931 by the establishment of a Standing Advisory Committee on Registration and Decasualisation and they issued two reports in 1932 and 1933.

In 1937 Ernest Bevin, who was then the General Secretary of the Transport and General Workers' Union, realising that the casual system of employment in the dock industry—where men raced from one call stand to another and actually fought for a half-day's work which resulted in the survival of the fittest—was an evil that should be stamped out for all time, renewed his claim for decasualisation.

It can be said that the point at issue between the employers and the Trade Unions then were identical to those of to-day. The number of men to be engaged and the amount of guarantee to be paid.

September 1939 found this country unprepared and faced with a war that threatened her very existence. The East Coast ports became immobilised, shipping scarce and dockers almost completely idle. Hundreds answered the call and volunteered for the armed Forces and were formed into the Stevedore Battalions who did a glorious job of work all over the world; others went into munitions, and aircraft production and gave loyal service to a country in need. To those who were left went the call for volunteers to hold themselves in readiness for immediate transportation to any port in the country where their services might be needed, and up to a point this proved fairly successful.

It was then realised, for security reasons, that it was absolutely necessary to have an efficient and mobile force that at a moment's notice could be transferred to any port to keep the supply lines moving. It was also realised that this could not be achieved unless some sort of a guarantee was given to hold together the men who would comprise this essential labour force. It therefore became necessary, again for security reasons, for the Rt. Hon. Ernest Bevin, who was then the Minister of Labour and National Service to instruct the industry to get together and form a scheme for his approval, in accordance with Article 58 A.A. of the Defence Regulations of 1939. It can be said that after months of negotiations a scheme was finally agreed and submitted to the Minister for his approval and from the force of circumstances, the need for National Security and self preservation, brought about by a declaration of war, that which was known over a number of years to be needed, was forced upon the industry and birth given to decasualisation. It was agreed that this child of fate should only have life for a probationary period and it was feared that when the war was over conditions on dock-side would go back to what they were.

Who was responsible for this short-sighted policy? Who could have thought for one moment that having once created something for which the industry had been crying out for years, it would be destroyed with the cessation of hostilities, and the evil days of casual labour revived? Fortunately, the Government has been wise enough to appreciate that a potential danger lay hidden and if any attempt was made to revert to pre-war practices, the industry would become a "hot bed," with the result that the Regulation of Employment Bill was passed through Parliament this year and the decasualisation of the Dock Industry assured.

The Dock Labour Schemes operated during the war period, although a long way from being perfect, did serve a useful purpose. It can even be said that in some instances they failed insomuch that shortages of labour occurred and the labour available was not suitable for the work offered, but this was due to the fact that over a considerable period before the war there was no recruitment to the Port Registers and the average age of the dock worker was very high, but this does not allow or give excuse to the thought that Dock Labour Schemes should go. In the main, they have proved very successful; work has gone on under very trying circumstances with nerves often at breaking point. True, the industry has not been without its labour troubles whilst the schemes have been working, but nevertheless experience gained over the last five years is priceless and can be put to very good use and it is up to the industry now to apply the knowledge gained by experience before it is too late, and agree on a permanent scheme.

Decasualisation means a happy industry, continuous employment for dock workers, a hundred per cent. efficiency, and a speedy turn-round of ships and an opportunity for this country to obtain first place in the race for the markets of the world.

To achieve this, both sides—employers and Trade Unions—must bury the hatchet. Customs and practices necessary in the days of casual labour must be swept aside. A guaranteed week is a logical assumption men must obviously be paid for their services and where piece work is considered essential, then the rates should be sufficient to create an incentive to earn above the guarantee. On the other hand, the men should be bound to accept at all times the work on offer, and it should be an offence to refuse suitable work. All disputes should be dealt with promptly by the industrial machinery. It should also be an offence to take unofficial strike action and the perpetrators should be instantly dismissed from their industry.

The industry has plenty of material to hand whereby it is possible to build a scheme that can be an example to all other industries, a scheme that can go down in the annals of Industrial History as an achievement worthy of a nation that goes over the seas in ships.

It is understood that if the industry fails to agree to a scheme, the Minister will have power to put into operation a scheme of his own. If this happens, then obviously something else will follow—we have heard a lot about Nationalisation. The Bank of England and the Coal Mines have already been Nationalised, Transport and Electricity are to follow. Would it be in the best interests of this country to Nationalise the Dock Industry?

Quayage Extension Works at Argentine Ports

By RAUL BUICH
of the Argentine Association of Engineers.

(Continued from page 125)

(2) Continuous Walls of Block Construction

This system is particularly suitable for those cases where the existing depth of water in the port is greater than or varies slightly from the final depth required for the proposed dock works, and at the same time where the foundations are of such a nature that the wall can be laid directly upon them. By their very nature these works can be undertaken below water level, thus effecting an appreciable economy over every other method, since processes such as compressed air are eliminated.

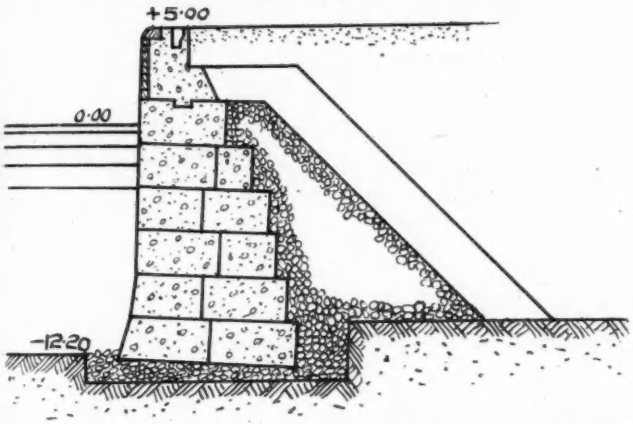


Fig. 12. Cross section of the concrete block wall in the Port of La Plata.

The largest works constructed by this means in Argentina are the dock walls at the Port of Mar del Plata, the cross section adopted being shown in Fig. 12. The work was carried out in three stages, namely:—

(a) A foundation of small stones laid in a dredged trench, levelled to the necessary slope by a diver.

(b) The sub-structure formed of mass concrete blocks, varying in weight from 32 to 42 tons, laid in course by means of a floating crane having a lifting capacity of 50 tons; the top of the blockwork is laid to a level 1.25 metres above datum.

(c) The concrete super-structure of the quay proper, faced with masonry and built to a height of 5 metres above datum, with a masonry parapet.

The total length of this wall is 4,050 metres, and its cost varied between 4,600 to 5,850 Argentine paper pesos per lineal metre for the wall of 30-ft. height and between 7,600 and 8,200 paper pesos per lineal metre for the 40-ft. wall, including compensation charges.

(3) Walls with Intermittent Foundations

This design is employed where a suitable foundation can be obtained only at great depth, in which case a continuous wall of full section would be prohibitive in cost, particularly where the work would be carried out below water. Briefly, this method consists of founding a number of caissons by means of compressed air within the firm ground; load bearing arches are then built between the caissons, the former being replaced by slabs of reinforced concrete in the more recent designs of dock walls.

The most outstanding work of this type built in Argentina is the masonry mole for the Port of Rosario, details of which are shown in Fig. 13; this was built by Hersent, Schneider & Co., the original concessionaires for the port works, and comprises a total length of about 2,400 metres. It is of similar design to that carried out at the Port of Lisbon, and consists essentially of a number of columns spaced at 16 metres centres and rising to a height of 1.50 metres above datum. The following constructional method was adopted:—

A caisson of sheet steel was built, having a length of 11.65 metres, a width of 5.40 metres and a height of 1.80 metres; the total weight was 18 tons and the triangular sectioned circumference was filled with concrete as well as the top portion. This was attached to the bottom of the main caisson, which was sunk into position by means of compressed air as shown in Figs. 14 to 19 inclusive, indicating successive stages in the process of construction. The height of the main caisson varied according to the nature of the foundation. When the caisson had penetrated 1 metre within the tertiary sandstone stratum it was considered that this provided a suitable foundation; the main caisson was then removed and attached to another foundation caisson, the process being repeated. A crane with a lifting capacity of 50 tons was employed for handling the former.

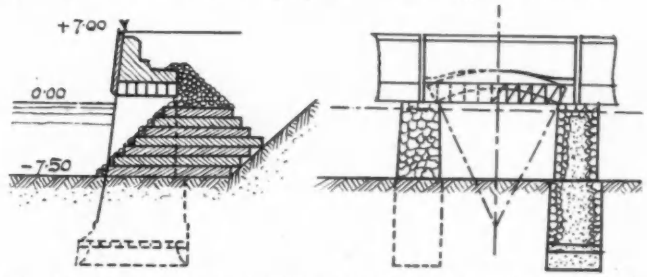


Fig. 13. Masonry wall for the Port of Rosario, with intermittent foundations.

After completion of excavation within the caisson, the latter was completely filled with hydraulic lime concrete and the compressed air tube was withdrawn as shown in the last sketch of this series. Since the caisson had to go down to a depth of as much as 23.50 metres below datum, when the height of the river was between 4 and 5 metres above datum, it was often necessary to work with compressed air up to a pressure of 3 atmospheres; in view of the large area of the foundations, this was a work of considerable magnitude. The super-structure embodies six reinforced concrete beams in the form of a lintel, each beam having a span of 15.50 metres and a depth of 1.50 metres. The greater part of the horizontal earth pressure is taken by the intermediate masonry, and the columns have more than ample strength to add to this resistance.

(4) Walls Constructed of Caissons Floated into Place

This is another method of constructing dock walls below water by employing large reinforced concrete caissons; these are built on slipways and transported by flotation, being filled with sand or concrete ballast when fixed in position in the dock works.

In order to reduce the length of the slipway and to simplify handling, it is good practice to reduce the draught of the caissons and thus their height; in no case, however, once the caisson is founded, must its top be below a level at which it is possible to concrete the top of the wall above water level. This requirement restricts the employment of this method to large ports where there is a limited tidal range, in order to avoid the use of unnecessarily large and high caissons.

*Report of a Lecture delivered to the Argentine Association of Engineers, held under the auspices of the Technical Division of Ports and Navigation, published in the February, 1945, and following issues of "La Ingenieria"; translated and abridged by Rolt Hammond, A.C.G.I., A.M.I.C.E.

Quayage Extension Works at Argentine Ports—continued

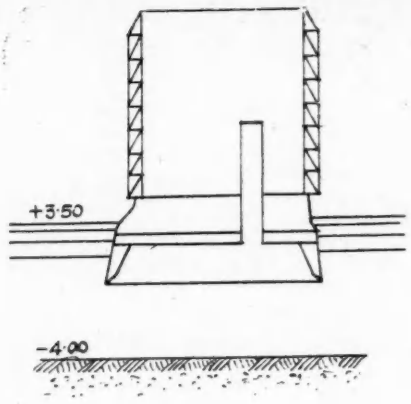


Fig. 14.

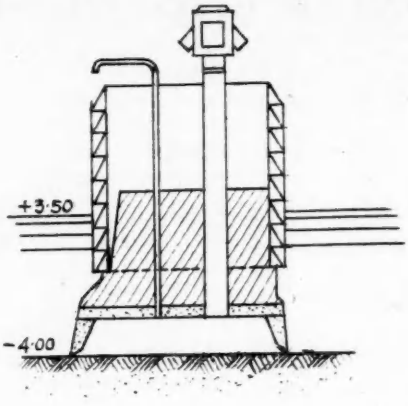


Fig. 15.

Fig. 16.

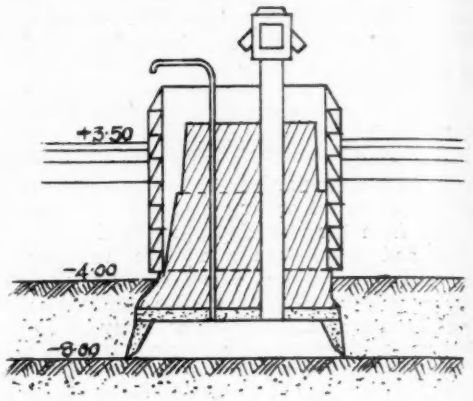


Fig. 14. Caisson used in the construction of the dock wall at the Port of Rosario; Fig. 15. Dock wall under construction in caisson at the Port of Rosario.

Moreover, this work requires advance preparation of a well-levelled foundation, a simple matter in the case of solid rock. Where there is no rock, a solid bed is formed by means of coarse sand or other selected material; after being allowed to settle in place for some time, this is spread to the correct level of the base of the foundation. This method of construction can therefore be adopted in those cases where good foundations are not obtainable at reasonable depth, and it often represents the simplest and most economical solution when choosing the section of the dock wall. The classic example of this type of work in our country is the dock wall at Arroyo Pareja, in accordance with the national concession originally granted to Mr. Pagnard acting on behalf of the Commercial Port Company of Arroyo Pareja, S.A.

For this work each reinforced concrete caisson has a length of 32.20 metres, a width at the base of 11.50 metres, a width at the middle of 8 metres and a height of 14.50 metres, as indicated in Fig. 20. The volume of reinforced concrete in each caisson is 474 cubic metres, reinforced with 115 tons of mild steel reinforcing bars. It was considered that the proportion of the latter, at 240 kgs. per cubic metre, was excessive. When once the construction programme had been fully organised, a caisson could be built in one month, taking into account all the operations necessary to prepare it for launching.

After dredging and preparing the small trench for receiving the caisson in its exact location, it was filled with concrete up to a level of 2.80 metres above the bottom of the foundation; concrete was then continued up the front portion of the caisson, as shown on the section. The rest of the caisson was filled with dredged material, the top part of the dock wall section consisting of a wall 2.50 metres wide up to a level of 6.50 metres above datum.

(5) Light Structures and Mooring Moles

Introduction.—The dock wall sections so far considered have been based on classic conceptions of engineering design. In many cases these do not provide a technical or economic solution under the following circumstances:—

(a) The material in the foundation is of poor bearing quality.

(b) Good ground is reached at a reasonable depth, but during excavation the intervening strata are subject to slipping.

(c) In certain cases already considered it is necessary to carry out dredging or excavation under water.

The thick alluvial strata, or those clay banks which frequently occur in Argentine rivers, have in many cases imposed upon our engineers the need to design dock works under the most unfavourable conditions; this has resulted in the adoption of light structures for dock walls. The older type of wall foundations on

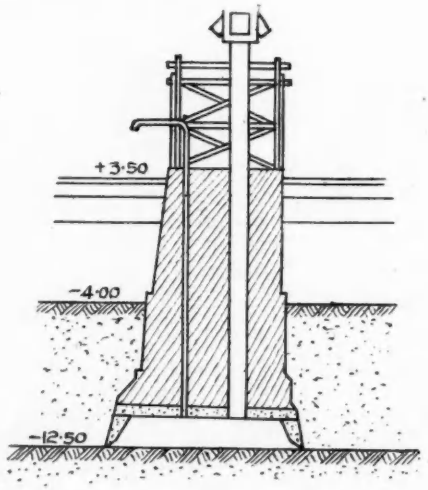


Fig. 17.

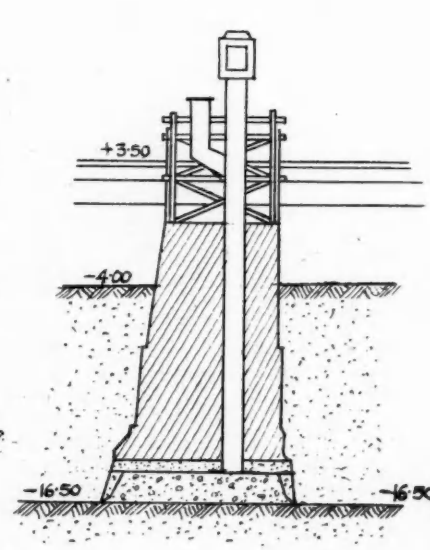


Fig. 18.

Fig. 19.

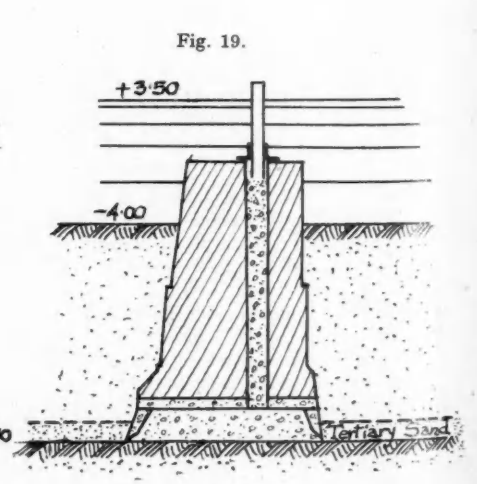


Fig. 16—19 inclusive. Successive stages in the construction programme for the dock walls at Rosario.

Quayage Extension Works at Argentine Ports—continued

cylinders has been rejected and has been used in certain cases with unsatisfactory results for works built by private concessionaires in the Port of Buenos Aires at very high cost. Our engineers have found the solution of the problem to be light structures supported by piles; at first these were of hardwood, but now they are generally of reinforced concrete.

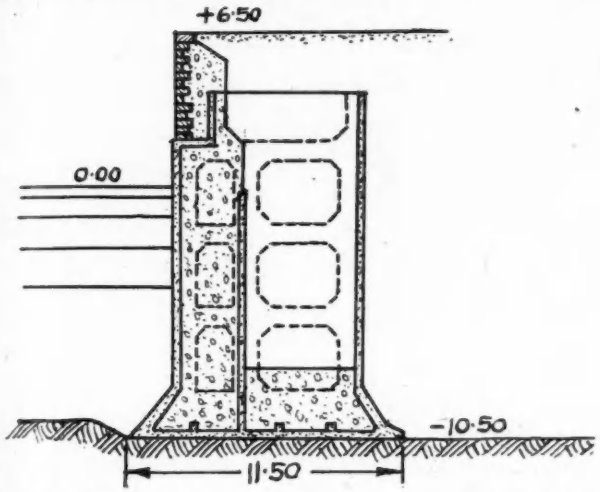


Fig. 20. Cross section of the dock wall at Arroyo Pareja, built with the aid of floating caissons.

Fundamental Basis of Design.—The first consideration in design is to reduce earth pressure on the wall. In Fig. 21, on the left, is a diagram showing the loading on the back of a continuous wall, assuming that the fillng has an angle of repose of 30 degrees; on the right is the diagram corresponding to a dock wall of similar capacity, in which piling is an integral part of the construction. In both cases, equal depth of foundation and equal loading have been assumed; in other words, from the shipping point of view, the two structures have the same capacity. Whereas in the continuous wall the load diagram shows a total pressure of some 62 tons per lineal metre, in the case of the piled wall the total pressure is 19.8 tons, of which only 11.4 tons is actually transmitted to the wall; the remaining pressure is sustained by the passive resistance of the piling system. In short, other conditions being equal, the piled structure receives only 18 per cent. of the horizontal pressure.

Moreover, according to the laws of statics, the stability of the continuous wall depends upon its resistance to sliding; whereas in the case of the piled structure the reaction of the buried piles to horizontal pressure is an important factor. Resistance to sliding in clay soils is low, and all walls of the gravity type are liable to slip on such soil.

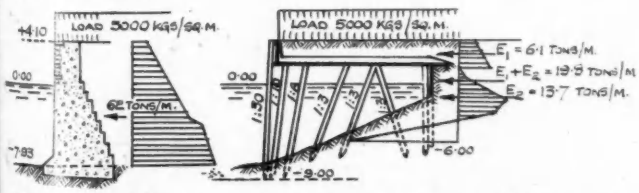


Fig. 21. Comparison between continuous wall of constant section and wall embodying piled construction.

Although there are certain marked advantages in favour of light structures, one of their most important disadvantages is that they have insufficient mass to absorb the kinetic energy of vessels coming alongside them. They also have excessive width due to the slope in the ground below them—which may well be of low quality—and there are also constructional difficulties due to the great depth to which piles may have to be driven.

Original Dock Walls Used in the Country.—Works carried out in various parts of the country incorporate the experience gained on works undertaken in the Port of Buenos Aires.

The first dock walls designed on a rational basis were those of the Port of Riachuelo, carried out under the supervision of Señor Luis M. Huergo, as an integral part of the plan for works authorised under the Law of December 14th, 1875, of the Province of Buenos Aires. These works consisted of simple shore defences in hardwood.

Dock Walls of the Candiani Type.—These were built of hardwood for a length of about 90 metres in the South Port and were completed in 1895, the work comprising four rows of piles with a timber flooring. The horizontal pressure is that due to a surcharge of about 3.20 metres, with the greater part of the lengths of the piles buried in the ground. Fig. 22 shows this wall.

(b) **Dock Walls of the Duclout, Durrieu and Butty Types.**—The engineer Duclout, without any fundamental modification to the Candiani wall, introduced a considerable improvement into the design of the super-structure by increasing its stability. He effected this by means of raking timbers as shown in Fig. 23, the weight of the earth filling having a stabilising influence. Dock walls on the north bank of the Riachuelo were constructed by Duclout, and had a total length of some 890 metres; they were built between the years 1893 and 1899 and their cost was about 800 paper pesos per lineal metre.

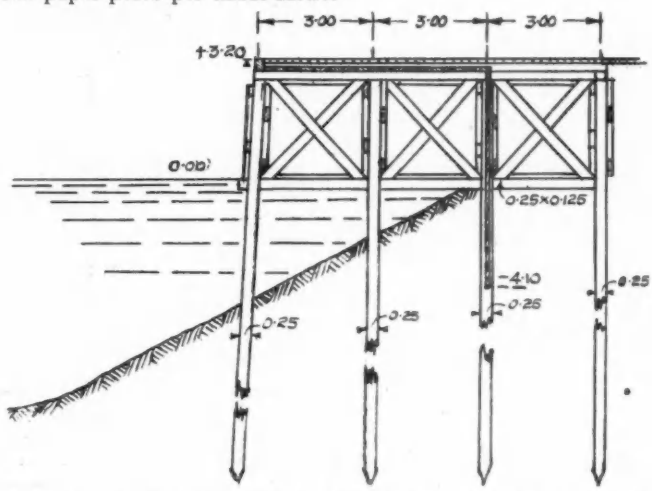


Fig. 22. Candiani type wall for the South Port, built entirely of timber in 1895.

(c) **Segovia Type Dock Wall.**—Here the designer has replaced the last row of piles by a pair of anchor piles, in the manner shown in Fig. 24. The total length built amounted to 1,200 lineal metres at a cost of about 610 paper pesos per lineal metre. Thus, for the first time, a large part of the horizontal pressure is transmitted to a fixed anchorage independent of the wall; the pair of piles is capable of resisting both tension and compression. In practice, the tie rods being inclined are subjected not only to the assumed axial loads but also to bending loads, which often cause their breakage. For this reason it was necessary to use the additional anchorage shown, which we shall describe later.

(d) **Works Constructed after the Exceptional Fall in the Level of the River Plate on 13th July, 1920.**—As a result of the extremely unfavourable conditions imposed upon the dock walls in the Riachuelo due to the lowering of the river water—greater by a metre than the maximum fall hitherto registered, which was that of 20th May, 1908, when the fall was 2.65 metres below datum—the following accidents occurred:—

(1) The collapse of about 200 lineal metres of dock wall of the Huergo type; a fact which could be foreseen due to the design having been prepared for a depth of water only 9-ft. below datum, that is to say very much less than the depth provided by subsequent dredging.

(2) Collapse of 340 metres of dock wall of the Duclout type; this accident was attributed not so much to the design of the wall as to the low bearing value of the short piles used in its construction.

Quayage Extension Works at Argentine Ports—continued

(3) Various displacements in the length of 1,088 lineal metres of wall built on the south bank of the river—with the Segovia type cross section—due to the failure of the short anchorages provided.

Experience proved that the dock wall sections of the Durrieu and Butty types have excellent stability in terrain of such low quality as that composing the banks of the Riacheulo. The double problem was presented of effecting improvements in the stability of the dock walls referred to above, and of providing dock walls with the necessary stability for a depth of 27-ft. below datum.

The first requirement, improvement of the existing dock walls, was met by the carrying out of the following works:—

(1) For timber walls of the Segovia type, anchorage in the form of tension rods was provided, and the walls were made capable of withstanding a pressure of 7.5 tons per lineal metre.

(2) For walls of the reinforced concrete Durrieu and Butty types, the anchorage rods were fixed to isolated beams spaced at 10 metres centres, each anchor having a bearing value of 75 tons; longitudinal rigidity was guaranteed by providing the

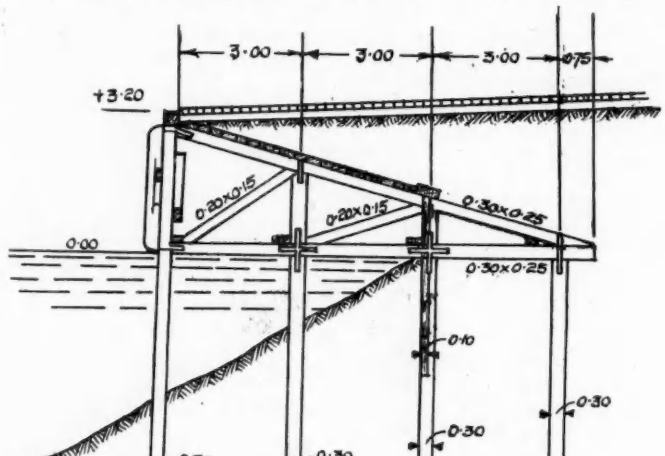


Fig. 23. Cross section of dock wall designed by Duclout, between 1893 and 1899.

necessary beams and the piles were lengthened in order to allow for the increased depth of Riachuelo. Furthermore, for the Durrieu type the super-structure was completely reconstructed in view of the low quality of concrete originally employed in 1905, when the technique of concrete work was not so advanced as it is to-day.

For the Butty type walls, under construction at the time of the lowering of the river bed referred to above, an additional anchorage was designed, the only difference from that of the existing wall being in the method of transmitting the load. On the other hand, for walls built soon afterwards, more rational sections were adopted to achieve the desired end. This is shown in Fig. 25, which depicts the cross section known as the "Butty C" type, originally constructed for a total length of 556 metres on the north bank of the Riachuelo at a cost little greater than 3,000 paper pesos per lineal metre. In order to be able to withstand the total load of 144 tons on each 10 metres of dock wall, the following factors were taken into account in designing the wall:—

(a) The horizontal component of the earth pressure acting on the piling system.

(b) The horizontal reaction of the two inclined piles considered as independent units and neglecting the favourable effect of their inter-connection.

(c) The difference between active and passive pressure acting on the back of the wall.

In short, a factor of safety of two can be guaranteed. In practice this is considerably greater, since it is increased by the embedded value of the piles which was not taken into account in the above calculations, an eloquent proof of the importance of this was provided by the fact that 1,300 lineal metres of the wall of Durrieu and "Butty A" types were unaffected by the fall in the river level on 13th July, 1920, due to this factor.

In studying the best section for a dock wall in the Riachuelo district, where good bearing ground can be depended upon at depths not greater than 9 metres below datum, the engineer Meoli

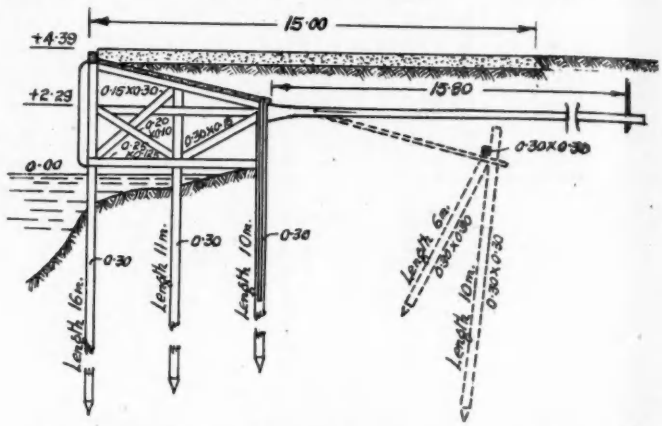


Fig. 24. Cross section of Segovia type dock wall, with anchor piles.

designed a completely different type of wall from that already reviewed (Fig. 26) in which the reaction to the total pressure of 15 tons on each 2 metres of wall was obtained in the following manner:—

(a) A horizontal reaction of 11 tons from the horizontal component of the thrust on the front row of the inclined piles.

(b) The horizontal reaction of the inclined piles at the rear of the wall accounted for the remaining 4 tons of horizontal thrust.

In order to increase the first reaction and thereby to avoid tension in the rear piles, the designer has arranged the horizontal slab upon which the embankment rests at the lowest level compatible with safety from floods; he has used the embankment as a powerful counterweight. He has achieved noteworthy simplicity of construction, eliminating the sheet piling required in the other designs which was very inconvenient for traffic; he has succeeded in obtaining the same factor of safety as in the Butty C type of wall. The total length of wall constructed with this type of anchorage is 1,742 lineal metres and its cost was about 2,500 pesos per lineal metre.

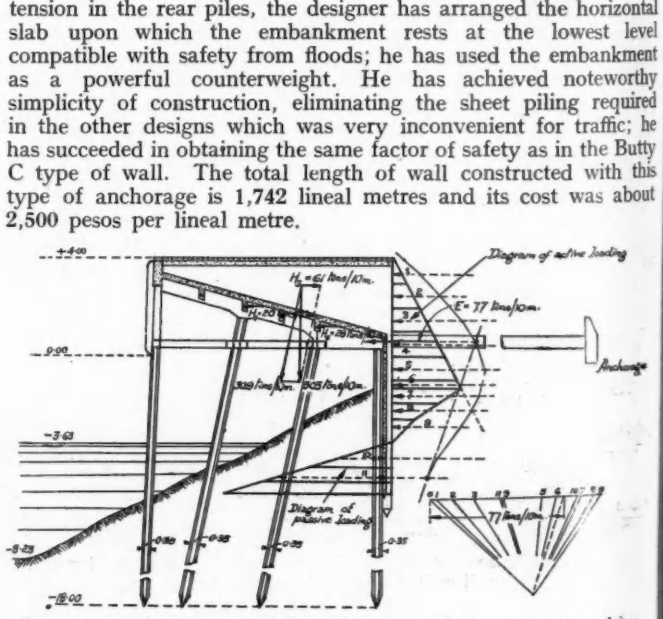


Fig. 25. Dock wall of the "Butty C" type, which was unaffected by the exceptional fall in the level of the River Plate.

Many other dock walls of similar type have been built in the Argentine Republic, in particular the following:—

(1) For the Subprefecture of the Tigre, with a depth of water of 7-ft.

(2) In the River Santiago for the Naval School, with a 10-ft. depth of water.

Quayside Extension Works at Argentine Ports—continued

(3) At the new arsenal in the same river with a 26-ft. depth of water.

(4) The dock wall on the east side of the South Dock, providing a depth of water of 28-ft., built of hardwood and mass concrete, owing to lack of suitable materials.

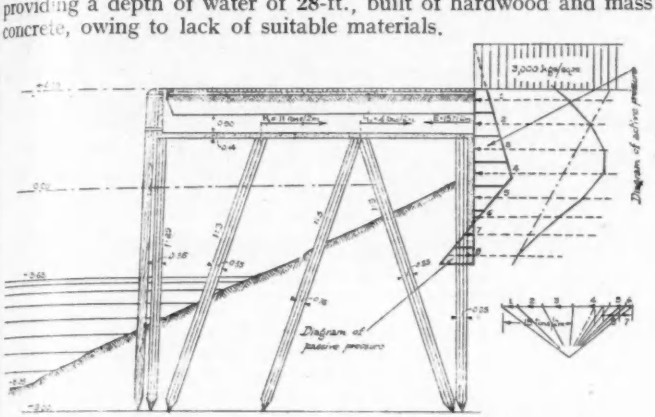


Fig. 26. Cross section of dock wall designed by Meoli to give a horizontal reaction of 15 tons on every two metres length of wall.

Works for Natural Sites where Conditions are Extremely Variable

The river system comprising our three great rivers the Parana, Paraguay and Uruguay, have such exceptional features that none of the permanent works already described is suitable. In effect, it is well known that the courses of such rivers, particularly the Parana and Paraguay, run through soft material of alluvial type and between banks which are frequently of clay material. As a result of this and of the incessant variation in the hydraulic regime, the position of deep water changes in an extremely capricious manner; this also applies to the river bank, the indispensable connection with the proposed port works.

If the rivers can be stabilised by such works as permanent dredging, port works of considerable size can be constructed such as those at Ibicuy, Rosario, Parana, Santa Fe, Diamante, La Paz, Gualeguay, Corrientes and Posadas, etc., on the Parana; Barranqueras and Formosa on the Paraguay and Concepcion del Uruguay, Gualeguaychu, Concordia and Colon on the Uruguay. The cost of such river improvements at ports of small size is economically unjustified, the expenditure exceeding that which would be spent on an entire port system.

However, where the position of deep waterways is naturally stabilised, with considerable fluctuation in water level, the construction of permanent port works is justified only if the traffic amounts to between 15,000 and 20,000 tons per annum. Whoever conceived the original idea of using our fine rivers, adopted moles built into deep water as the solution of the problem. Unfortunately these moles constituted permanent obstructions to flow and were either swept away by the current or rendered useless by the banks piled up against them.

Permanent port works are not the solution for the problem of small ports, whether or not there is artificial stabilisation of the waterway. The port installation should provide sufficient flexibility, at the same time rendering it adaptable to any particular site.

We therefore arrive at a type of work essentially different from those already described; the main part of which is a raft or pontoon, designed as a floating landing stage (Fig. 27). This system can easily accommodate itself to variations in the depth of water and can be used by any river level within the limits imposed upon it by the access works. Twenty floating ports of this kind were authorised to be constructed on the three rivers mentioned above by Law No. 10927 and a total credit of 3,500,000 pesos was granted for this purpose; the following works were planned at each port:—

(a) A floating landing stage.
(b) A transfer bridge.
(c) Defence works on the river bank.
(d) The necessary ancillary works for the development of the port, such as access roads and cargo handling facilities.

Two schemes, providing similar facilities, but having different dimensions, were adopted for the construction of the floating element; the length of the latter could be either 39.30 or 51.30 metres. In both cases reinforced concrete was the material adopted, for this has the great advantage of practically negligible cost of upkeep. It has been found in practice that a concrete pontoon will last for nearly twenty years, in places remote from dockyard facilities where any repair might involve considerable expenditure of time and money.

(1) **Floating Landing Stage with an Overall Length of 39.30 Metres.**—This has a beam of 11.30 metres, a displacement of 565 tons and carries a maximum load of 200 tons, with a maximum and minimum draft of 1.40 and 0.93 metres. It is provided with a shed 25 metres long and 8 metres wide, equipped with a store for goods, a second-class waiting room and facilities for the despatch of mails. On the roof is a first-class waiting room and cloak room. Hardwood beams, arranged horizontally and vertically, and double walls of reinforced concrete provide adequate strength to resist the impact of ships coming alongside the pontoon.

The estimated cost of such a pontoon with this complete equipment, is 146,423.66 pesos, the total cost for the 20 units approved by Superior Decree of 31st December, 1920, amounting to 2,738,473.20 pesos. Later this number was reduced to six, and eventually twelve units of 51.30 metres length were built instead.

(2) **Floating Landing Stage with an Overall Length of 51.30 Metres.**—This has a beam of 11.42 metres, a displacement of 800 tons, and carries a load of 255 tons; the maximum draft is 1.48 metres and the minimum 1.04 metres.

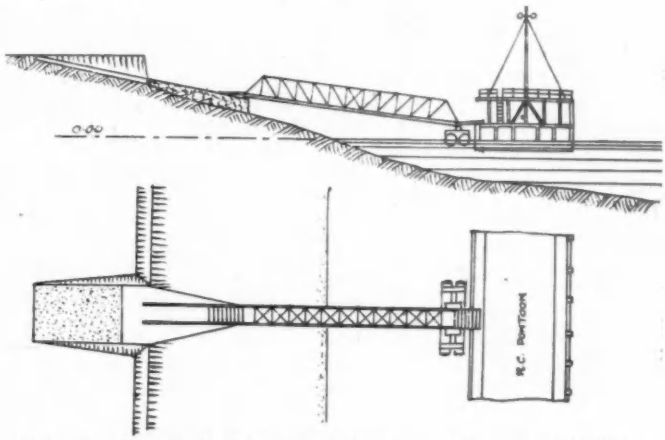


Fig. 27. Floating landing stage of reinforced concrete, which can accommodate itself to variation in the river level.

In this case the super-structure is 33 metres long and 8 metres wide; this has a store for goods, a light crane for handling cargo, a waiting room and its adjuncts, and offices for the examination of Customs and mails. The general design of the pontoon itself is similar to that of the 39.30 metre pontoon. The estimated cost of the longer landing stage is 218,409.34 pesos which includes all equipment.

Errata. We regret a printing error appeared in the footnote on Page 115 of the September 1946 issue. The correct formula should read as follows:—

*The velocity of tidal currents in an estuary is of the order of

$$\frac{\sqrt{g}\,.\,h}{2\sqrt{d}} \quad \text{or} \quad \frac{\sqrt{gh}\,.}{2}\,.\sqrt{\frac{h}{d}}$$

$$\text{or} \quad \frac{\sqrt{gd}}{2}\,.\,\frac{h}{d} = \sqrt{gd}\,.\,\frac{h/_2}{d}$$

when h is the range and d is the still water depth, *e.g.*, h=8 ft. and d=32 ft., v=6 ft. per sec. or 3.6 knots.

The Port of Dublin

Extensive Development Plans

The following information regarding developments at the Port of Dublin has been received from Mr. F. W. Bond, B.A.I., M.Inst.C.E.I., the Chief Engineer to the Dublin Port and Docks Board.

Work has been in progress for some time on the rebuilding of the quay walls at Custom House Quay, involving the removal of old timber jetties and construction of a new mass concrete wall, providing a depth in berth of 15 to 16 feet at L.W.O.S.T. instead of the present depths of 7 to 14 feet. The total length of quay being rebuilt is about 1800 feet, of which about 550 feet have now been practically completed. In connection with this scheme two old transit sheds are also being replaced by new sheds with a total length of about 830 feet, of which about 300 feet have now been completed. Electric cranes will be installed at these berths.

Work has also been resumed on the construction of a spur wharf at the East end of Alexandra Basin, which when completed will provide 1920 feet of berthage with a depth of 35 feet at L.W.O.S.T. and 1100 feet with a depth of 20 feet at L.W.O.S.T. A length of 220 feet of deep berthage has been completed and construction of a further 440 feet is in hand, the reinforced concrete caissons having been founded and filling is in progress. This quay will be equipped with electric cranes, tramways and transit sheds. Orders have been placed for 26—4 ton electric portal cranes for the equipment of new berthage and improvement of craneage facilities on the quays. It has been decided to extend the crane rails on the North Quay Extension for a length of about 1240 feet on North Wall Quay.

It is intended to increase the transit shed accommodation on the North Quay Extension by the removal of an old single storey shed 500 feet by 55 feet and construction of two double storey sheds providing a total covered area of 100,000 square feet. The first section of this scheme has been completed.

It is also intended to erect double storey transit sheds on Alexandra Quay and construction of the first of these, providing a covered area of 54,000 square feet, will begin very shortly. Arrangements have also been made for the extension of the privately owned grain discharging plant at this Quay.

Plans are being prepared for a new general warehouse at Alexandra Quay. This will have a capacity of about four million cubic feet. Construction is expected to begin next year.

Reference has already been made in the May 1946 issue of the Dock and Harbour Authority to the decision to construct a new Graving Dock. This will be located on the East side of the existing Graving Dock and will have a length of about 630 feet, width at coping 100 feet, width on floor 80 feet and depth on floor 15 feet at L.W.O.S.T. It is not yet possible to say when construction will commence.

A number of other schemes, including the deepening of the approach channel across the Bar, are under consideration but no details can be given at this stage.

Publication Received

British Standard Specification for Fire Check Flush Doors (B.S. No. 459, Part 3, 1946).

A further addition to the series of British Standard Specifications for doors has just been made by the issue of B.S. 459, Part 3. The specification lays down details of the quality of the material to be used and describes a construction of door which having been tested in accordance with the requirements of B.S. 476 has been found to act as an effective fire barrier for 30 minutes.

It is realised, however, that the fire-check requirements may be satisfied by doors of other types of construction.

An Appendix to the specification describes the door frame which is necessary if the door is to fulfil its intended purpose.

Copies of the specification are available from the Offices of the British Standards Institution, Publications Department, 28, Victoria Street, London, S.W.1, price 2s. post free.

GOVERNMENT SURPLUS STORES.

THE MINISTER OF SUPPLY has for immediate disposal the following Winches, located as shown below:

Item 1.

S. 1851/0/4. AR. 3289/1. 1—Electric Haulage Winch. Hauling capacity about 10 cwts. Single drum, capacity 300-ft. Complete with "Croft" worm and spur reduction gear unit, and B.T.H. electric motor suitable for supply 400/440 volt, 3 phase, 50 cycles. Condition good, but needs minor overhaul.
Location: Thomas Firth & John Brown, Limited, Atlas & Norfolk Works, Sheffield.
Inspection: Application should be made in writing to Messrs. Thomas Firth & John Brown, Ltd., at the above address, for the attention of the Chief Buyer.

Item 2.

S. 1852/16/7. AR. 3026/7. 1—Electric Winch by John Smith (Keighley), Ltd. Capacity 2 tons, single drum, 16-in. diam. by 3-ft. 6-in. long. Complete with electric motor, starter, switch, control box, etc. Suitable for 630 volt D.C. Condition good, unused.
Location: L.P.T.B., Parsons Green Depot., London, S.W.6.
Inspection: Application should be made in writing to The London Passenger Transport Board, Works and Buildings Engineer, Parsons Green Depot.

Item 3.

S. 1943/51/3 & 4 AR. 3210/1. 2—Steam Winches, ex Trawlers. By John H. Wilson & Co., Ltd., with Warping Barrels. Reversing working pressure 120 lbs. per sq. in. Driven from Ship's Boiler. Cylinder 8-in. bore by 12-in. Bedplate 4-ft. by 3-ft. 4-in. Condition serviceable.
Location: D. W. Henderson, Meadow Side Works, Partick, Glasgow.
Inspection: Application should be made in writing to Messrs. D. W. Henderson at the location as above.

Item 4.

S. 1912/20/2. AR. 3927/1. 1—Winch, single drum, by M. B. Wilde & Co., Ltd. 2 tons capacity. Driven by petrol vehicle engine through power take off shaft on vehicle. Designed for use with "Humber" 6 by 6 Prototype 15 cwt. vehicle. Condition unused.
Location: Humber, Ltd. (Chassis Export Dept.), Stoke, Coventry.
Inspection Application should be made in writing to Messrs. Humber, Ltd., at the location as above.

Arrangements for inspection can be made only by prior application to the addresses named, but no facilities are available for working or load tests.

Purchasers must take delivery as and where lying and accept responsibility for dismantling (if necessary) and removal from site within two weeks of the date of issue of Release Instructions.

Offers for any or all of these items are invited. No Forms of Tender are necessary and letters should be addressed to:—

Ministry of Supply,
Director of Contracts,
Gt. Westminster House,
Horseferry Road,
London, S.W.1,

to arrive not later than 10 a.m. on 18th October, 1946. Envelopes must be marked "Tender No. 205301, returnable 10 a.m. 18th October, 1946." Failure to mark the envelope correctly may result in a Tender not being considered.

Any Contracts made as the result of this tendering will be subject to the Department's usual Conditions of Sale (Form C.C.C./Sales/1), a copy of which may be obtained, if desired, from the Ministry of Supply, Contracts Directorate (C.B. 4), Great Westminster House, Horseferry Road, London, S.W.1. Reference Tender No. 205301 12/Sales (R.E.)/6624 should be quoted when applying for this Form.

FOR SALE.

AN AUTOGRAPHIC TIDE GAUGE MACHINE, all brass, needs cleaning and slight repairs, £25. Box No. 99, "The Dock & Harbour Authority," 19, Harcourt Street, London, W.1.

BUSINESS ANNOUNCEMENT.

MESSRS. HAMILTON'S LILYFLEX SURFACES, LIMITED, 16, Howick Place, London, S.W.1, the patentees of "Lily" and "Swiss Roll" Floating Surfaces for Jetties, etc., announce that Mr. R. M. Hamilton and Mr. H. C. Bevan are visiting Canada and the U.S.A. and will be pleased to deal personally with all enquiries. They will be staying at the following hotels on the dates specified:—

Ritz Carlton, Montreal ...	28th October to 3rd November, 1946.
Fort Garry, Winnipeg ...	4th and 5th November, 1946.
Hotel Vancouver, Vancouver	6th and 7th November, 1946.
Ritz Carlton, New York ...	9th to 15th November, 1946.